Vol. VI. OCTOBER, 1916. No. 10.

OCT 10 1916

AMERICAN JOURNAL of PUBLIC HEALTH

THE JOURNAL OF THE AMERICAN PUBLIC HEALTH ASSOCIATION

Edited by
SELSKAR M. GUNN

A Plan for the Education in Industrial Hygiene
J. W. Schereschewsky, M. D.

A Study of Methods for Determining Air Dustiness
George T. Palmer, Laurence V. Coleman and Harry C. Ward

The Control of Communicable Diseases in Schools
S. Josephine Baker, M. D.

Organized Hygiene
Eugene C. Howe

Published Monthly at
10 DEPOT STREET, CONCORD, N. H.

Editorial Office
755 Boylston Street, Boston, Mass.

Entered as Second Class Matter at the Post Office at Concord, N. H.

AMERICAN PUBLIC HEALTH ASSOCIATION, ANNUAL MEETING, CINCINNATI, OHIO, OCTOBER 24–27, 1916.

PITTSBURGH MODEL

HORIZONTAL AUTOCLAVE

NEW DESIGN FULL NICKEL PLATED

The only Autoclave using foot power for opening and closing the door.

Thus the operator has both hands free to pack the autoclave or remove the contents, and there is no necessity for touching the unsterile exterior.

The generator is enclosed in the pedestal.

The heat is thereby confined and concentrated where it is needed. This is a valuable feature where gas or electricity is used.

The door is of a greatly improved design.

It has a ground metal-to-metal joint; and in opening, it swings upward on the inside of the autoclave.

Size No.	1	2	3	4	5
Door, inches	10	12	14	16	18
Diameter, inches	16	20	22	26	28
Length, inches	20	24	28	30	38
Net	$151.00	216.00	311.00	401.00	493.00

(Price for Autoclave with electrical heat, on request.)

SCIENTIFIC MATERIALS CO.

PITTSBURGH, PA.

Headquarters For Laboratory Apparatus

We have the most complete stock of filter papers in the world. Just received a large shipment from Germany.

American Journal of Public Health
Official Monthly Publication of the American Public Health Association
Vol. VI OCTOBER, 1916 No. 10

A PLAN FOR EDUCATION IN INDUSTRIAL HYGIENE AND THE AVOIDANCE OF OCCUPATIONAL COMPLAINTS.

J. W. SCHERESCHEWSKY,
Surgeon, U. S. Public Health Service.

Read before the Industrial Hygiene Section American Public Health Association, Rochester, N. Y., September 7, 1915.

The keynote to the betterment of conditions of industrial occupation is education. Such education cannot be limited to one class but must include all units of society. Doctor Schereschewsky here discusses the type of education necessary to each unit, the worker, the medical profession, the general public, and suggests methods by which results may be effected.

IT MUST be confessed that this subject is one to be approached in a spirit of diffidence for the reason that the results to be effected are so far-reaching and of such fundamental importance, the methods employed play such a leading part in the final result, and finally, the inauguration of any thorough plan of education will cost so much money, that the writer may well be excused for a tentative spirit in making suggestions.

There would hardly seem need for an extended discussion of the necessity for education in industrial hygiene and the avoidance of occupational complaints. There are approximately from 25,000,000 to 30,000,000 industrial workers in this country, all of whom are more or less exposed to health hazards. While many of these are the ordinary health hazards, present in the industrial as in any other sphere, on the other hand many of them are inherent to the occupation in question. There can be no doubt but that the steady operation of these hazards exerts a deleterious influence upon the health of the individual, while many of them seriously menace life or curtail the period of productive activity.

One of the most important results effected by the present "Safety First" campaign is that our eyes have been opened to the fact that it is not sufficient to make industries "safe" from an accident standpoint; they should be "safe" from a health standpoint as well. In other words, no industry ought *per se* to exert an injurious influence upon the health of

the worker, in no industry should occupation therein entail curtailment of the period of economic activity.

While, in the absence of reliable statistics, we can only approximate the average yearly loss through the sickness of workers, figures which have been published in Europe enable us reasonably to conclude that the average annual loss through sickness, to workers in this country, is not far from eight to nine days. This would amount to some 600,000 years each year, or an economic loss of $360,000,000 if average annual earnings are $600. The loss due to premature physical decline or to reduction in productivity, the result of the continuous operation of industrial health hazards, cannot as yet be estimated. This can only be arrived at as a result of future studies which are highly necessary.

A large part of the loss just adverted to is preventable and is due to lack of knowledge or to carelessness. It need hardly be said that the need for the conservation of human life and health was never more imperative than it is today. The gigantic destruction now going on daily in the vast conflict of European nations only emphasizes the urgency for methods of conservation of life and health. In addition to this, our attention is being repeatedly called to the alarming increase in the so-called "diseases of degeneration." The conclusion seems inevitable that this increase can be due to nothing else but the operation of modern conditions of civilization which have modified, more than in any other particular, the ways in which man gains his daily bread, *i. e.*, industrial conditions.

Clearly there is need that something should be done. We all know, from the history of campaigns in the interests of the public health in the past, that education is our most effective means for improving health conditions. A more difficult question is the consideration of educational methods and the social groups to whom this education should be directed. A short consideration will convince us that it will not be sufficient to educate workers alone. The field to be covered is more extensive. Not only must the worker be reached but educational measures must extend to the general public and the medical profession.

Any plan for education must, therefore, be general in nature because of the close interdependence of all the units of society. Thus, the education of the medical profession is needed for the purpose of stimulating the interest in the study of diseases in relation to occupation, the improvement in collection of clinical data bearing upon occupational diseases, and the promotion of research work along these lines so that practical recommendations for advances in the sanitation of industries may result.

The education of the general public is required, first, because the history of all our constructive health legislation of the past shows that an enlightened public opinion is necessary to success, and, second, because it is impossible so to delimit the field of industrial hygiene as to separate it from the hygiene of the total environment. Moreover, employers of labor

are an important class of the general public. Their coöperation is necessary if industrial health conditions are to be improved. Finally, the workers, themselves, are to be educated. In order to secure substantial improvement in the health conditions of industries, we must insure knowledge, on the part of the worker, of the general principles of industrial hygiene and the care of his own body. Otherwise, provisions for his health and safety will, in the absence of his intelligent coöperation, be largely nullified.

I will now endeavor to discuss briefly the kind of education each of these three classes require and suggest possible methods by which results may be effected. It is evident, however, the limitations of time will permit only the merest outline.

Beginning with the medical profession, the recognized source of most of our hygienic information, it is only too plain that study of the relation of disease to occupation is regarded as a specialty and something with which neither the general practitioner nor the specialist in other fields is very closely concerned. Yet industrial workers constitute by far the largest class of medical patients. It is evident to any one who examines the clinical records of the average hospital, that with a wealth of material for study, with but a few exceptions, scant attention is paid, for the most part, to the relation of industrial health hazards and of occupational diseases to the morbid history of patients in such hospitals. Even the occupation of patients is imperfectly ascertained, the data on this point in most hospital histories being so vague and unreliable as to be practically valueless.

The influence of industries upon health is a subject which has been hitherto sadly neglected both in our medical curricula and at the bedside. There is, therefore, need to educate the medical profession to the importance of industrial hygienic measures and the study of the relation of occupations to diseases.

Inasmuch as hospitals are the chief sources of clinical material, hence, the natural locations where intensive studies of disease may be made, it is clear that here must begin the first steps in the education of the medical profession. As Hayhurst has pointed out, the first thing necessary to the utilization of hospitals as centers of education in industrial hygiene, is the adoption of a uniform nomenclature which shall exactly designate the occupation of hospital patients. In taking histories, similar standards are required which will furnish information as to the previous industrial history of the patient and the relation, if any, of this to his previous or present morbid history. At all clinics for the instruction of medical students, stress should be laid upon these points by the demonstrator so that all such students may gain an idea of the important bearing of such data upon disease.

It is also important that death certificates should correctly and exactly indicate the occupation of the decedent. The instruction of the medical profession in this matter is primarily the function of registrars of vital statistics. There is room for improvement in the form of death certificates

themselves in that these should provide more fully for the accurate description of the occupation besides permitting the notation of previous occupations and the time each was pursued. Accurate information of this kind would be invaluable in the study of the mortality of occupations.

The increase in the interest of study of the relation of occupation to disease produced in medical centers of instruction by the measures thus roughly indicated, even if carried out in a relatively small number of hospitals, could hardly fail to produce the accumulation of valuable information.

This, together with the interest aroused in the general medical profession, would not only be productive of useful suggestions for intensive research and the improvement of the hygiene of industries, but the importance of the study of the relation of occupation to disease would also become so well recognized that thorough instruction in this subject would be part of the regular curriculum of medical schools. One important result would be an increase in the number of physicians qualified to undertake the medical care and supervision of large industrial plants.

Turning to the question of the education of the general public and of workers, this will be considered under one head for the reason that the latter are but a subdivision of the former. All are in need of education in these particulars, the only difference being that in the case of workers, the education should be somewhat more specific to suit the occupation followed.

It is plain that, while we may leave, to a certain extent, at least, the education of the medical profession to centers of medical instruction, some of which, I am glad to say, are recognizing the importance of instruction of this character, the education of so vast a body as the general public must be the result of governmental coöperation, federal, state, and municipal, allied with other civic agencies, such as associations formed for the betterment of industrial conditions and the trades unions of various industries.

Before any such coöperation can be effective to its fullest extent, there is certain preliminary work to be undertaken which, while it need not prevent the initiation of educational measures, will, when completed, add to their force and definiteness. By this preliminary work I refer to the creation of uniform minimum standards of industrial sanitation and legislation. In as much as the federal government is recognized as the standard-making agency par excellence in this country, it would seem that the formulation of the standards referred to is peculiarly the work of federal authorities.

The adoption of such standards, once they are formulated is, of course, the work of the legislative authority of the several states. The adoption of such standards, while not interfering with any additional precautions states or municipalities may see fit to enforce, or employers of labor or labor organizations voluntarily to adopt, will at once give emphasis, clarity and uniformity to an educational propaganda, in that such standards necessarily define the scope of the information disseminated, increase its author-

ity, limit the introduction of irrelevant material, and avoid the advocacy of conflicting measures in various parts of the country.

The history of the educational campaigns of the past, such as, for instance, the crusade against tuberculosis, and the undue mortality of infants, also that of the present campaign for the prevention of industrial accidents, furnish us with a number of means by which information in regard to industrial hygiene and the avoidance of occupational complaints may be generally disseminated.

These summarized roughly are:

1. Permanent exhibits.
2. Travelling exhibits, including moving pictures.
3. Popular lectures.
4. Bulletins issued for popular distribution by federal, state, local health authorities and by private associations.
5. Popular articles published by the Press.
6. Instruction in public schools.

Permanent Exhibits.—The museum of industrial hygiene is a powerful instrument for public education wherever located. Certain museums of industrial hygiene, located abroad, such as the one at Charlottenburg, for example, have aroused much popular interest, necessitating an increase in their funds and enlargement of floor space.

Steps should therefore be undertaken for the establishment of such museums in our important industrial centers. Such a museum is already located in New York City. I believe that such museums should, in size and importance, be on a par with the magnificent museums of natural history common in our large cities, through which an interested throng of visitors is constantly passing. A sufficient number of such museums of industrial hygiene situated throughout the country would, undoubtedly, play an important part as centers for the dissemination of information in respect to industrial hygiene.

Travelling Exhibits.—One need hardly point out the efficiency of the travelling exhibit, in that it goes to the people, rather than they to it. As the material for such exhibits is naturally limited to the amount and dimensions required for easy transportation, much of the success of such exhibits depends upon the personality and training of the demonstrators who travel with it and the discrimination with which it is planned.

I know of no other way, however, by which such large numbers of persons may be reached and impressed in so short a time as by means of the travelling exhibit. Moreover, such travelling exhibits possess the further advantage that their subject material may be modified to meet the industrial conditions of the region through which it is travelling. In this way the special information needed in the premises is disseminated. As state health authorities frequently employ this method for educating the public in regard to other health matters, the use of such exhibits for educational purposes in industrial hygiene would be merely the extension of former activities.

Naturally, the moving picture forms a means for reaching an extensive

audience which has been largely used in the past for educational purposes. In similar fashion, they constitute an important and readily available means for popular education in industrial hygiene.

Popular Lectures.—Many state and municipal health organizations now possess a staff of lecturers who deliver popular lectures upon health subjects. It can readily be seen that it is practicable to expand existing organizations to provide for the present necessity for popular instruction in industrial hygiene.

I pass over popular articles and bulletins dealing with this subject as their sphere and utility has become well defined through previous public health activities in other directions.

Instruction in Public Schools.—Provisions are made in the public schools of most states for the instruction of school children in hygiene. There is still a tendency on the part of the general public to take such instruction too lightly, or to regard it somewhat in the nature of a fad. Yet all who have investigated this subject cannot but be impressed with the fact that personal hygiene is the most important factor in maintaining the health and efficiency of the individual, due provision having been made to secure healthful places of employment.

In a recent investigation among the garment workers of New York City, made by the Public Health Service, in 1914, neglect of the principles of personal hygiene was found to play a leading part in the incidence of defects and diseases among these workers. Inasmuch as probably one third of all school children will subsequently engage in industrial occupations, while the great majority of males, in this country, are employed, upon reaching manhood, it seems obvious that the proper time to equip the citizen with the hygienic knowledge necessary to enable him to care for his body properly is not after he has entered a given occupation, but is an essential part of the training of the years of growth and development. Real knowledge of personal hygiene is quite as important for the citizen of the future as a knowledge of reading and writing. It would seem, therefore, particularly in connection with the vocational trend observable in the curricula of our most progressive public schools, that the courses of instruction in hygiene ought to be amplified and modified in such manner that the instruction in personal hygiene shall be thoroughgoing and apply especially, not to the present alone, but to the future maintenance of the body in health, after entrance into an occupation.

We must, therefore, consider the public school as an important instrument for improving the hygiene of workers of the future.

Considering immediate measures to be adopted for the education of the present generation of workers, it must be confessed that the outlook is not so hopeful in so far as the expectation of results commensurate with the effort expended is concerned. No doubt we must await the advent of the succeeding generation for the full fruition of our educational measures. One would hardly expect busy workers of the present, intent upon other

things, suddenly to acquire a lively sense of the importance of industrial hygiene and attention to the care of the body. A fortunate countervailing circumstance is the present campaign in the interests of industrial safety which has already prepared the ground, awakened the minds of the present-day workers to the value of life and limb and set in motion a complicated machinery for education in the prevention of accidents.

The existing apparatus for the promotion of industrial safety should, in addition to the activities of federal, state, and municipal health authorities, furnish a useful nucleus for the propagation of education in industrial hygiene and the avoidance of occupational complaints. Besides this we have the various labor organizations which should be enlisted in an educational movement for the improvement of the health of their members.

There remain the employers of labor. The concept is fast gaining ground among them that the individual is one of society's precious assets; that the condition of his health is not a matter of indifference, that it is poor social economy to subject workers to avoidable industrial hazards. As a consequence many employers are now beginning voluntarily to improve working conditions in their plants, supervise the health of their personnel, and attempt educational measures among them. The conservation of the health of workers, the improvement of conditions of employment, apart from purely humanitarian aspects, have been found to yield increased efficiency and economy in production, have fostered the spirit of coöperation. The prediction may well be ventured, therefore, that employers will be found in a receptive attitude so far as educational measures are concerned.

What they will ask for, and rightly I believe, is precise information as to the improvements it is desired to effect and the practical means for carrying them out. It is here that the establishment of minimum hygienic standards will be especially valuable, as these constitute excellent guides.

There remains for discussion the agencies by which such an educational campaign may be put into operation. This campaign must be a coöperative enterprise. So far as the federal government is concerned, agencies already exist which can contribute their share. For instance, the Public Health Service is empowered by law to study the diseases of man and is conducting investigations in occupational diseases and the relation of occupations to disease. It stands ready to coöperate with state and municipal health authorities in the study of conditions of industrial hygiene insofar as its facilities permit. In some state and municipal health organizations provision is made for the study and the dissemination of information in regard to industrial hygiene and the prevention of occupational disease.

It needs, therefore, only an extension of agencies already in existence and coöperation in order to call into simultaneous being a number of centers making educational efforts. Boards of education can assist in a material way by improving and revising the methods of teaching hygiene in public schools

so that such teaching shall have a vocational trend, *i. e.*, that it shall fit our embryo citizens for their life's battle, with special reference to their future occupations.

Besides these strictly governmental agencies we have trades organizations and associations of private individuals, such as the National Safety Council, who can exert great educational influence among their members. As an example of such organizations may be cited the Joint Board of Sanitary Control of the Cloak, Suit and Skirt and Dress and Waist Trades of New York City. This Board, organized by mutual consent of the manufacturers and of the unions of these industries, has cognizance of the sanitary conditions in the workshops of the allied industries. Similar organizations in other industries might well wield great educational forces, which, coöperatively directed, should play an important part in the campaign for industrial health.

In conclusion it may be said that the need for an intensive campaign for education in industrial hygiene and the avoidance of occupational complaints is an actuality, that agencies already exist by which such educational measures may be put into operation. What is mainly required is coöperation and the making of a beginning.

CANCERS.

L. I. Dublin, New York (*Journal A. M. A.*, Sept. 16, 1916), discusses the question of the increase of cancer at the present day. He remarks on the unreliability of statistics and in explaining the apparent increase of the disease, we must consider the marked improvement in registration in our country in the past fifteen years and the better diagnoses by physicians, resulting from the increase of operations and laboratory examinations. There are already indications that the cancer rate has reached its highest point and that in certain communities it is beginning to decline; but whether or not it is on the increase, the cancer rate is excessively high and is a real menace at the present time. He analyzes the statistics of the Metropolitan Life Insurance Company which represents over 10,000,000 persons and are of especial value on account of their intrinsic accuracy. It has been often said that cancer is a disease of the well-to-do, but if the insurance figures show anything, it is that the industrial classes enjoy no advantages, and he also finds little to justify assertions that have been made that certain races enjoy special or partial immunity. As to the ratio between males and females, he finds about half the cancers of white males affect the stomach or liver, and about 20 per cent. more other parts of the digestive tract, making altogether over 70 per cent. of cancers in males. Among females cancer of the genital organs and cancer of the breast are very prominent. Cancers of the skin are much more numerous in men than in women and the rate is extremely low for colored persons and practically negligible in colored women. In general there is a larger proportion of surgically accessible cases in women than in men. The average age of death from cancer in all forms is about 2½ years less in women than in men. Consideration of the average ages at death is important because they indicate the loss to the community from cancer deaths. At the present time a conservative estimate places the total number of cancer deaths in the United States at 80,000 a year—an aggregate of 1,200,000 years of life. The question, however, is not primarily economic but to allay the suffering and, if possible, extend to the persons of middle life and early old age a few additional years of enjoyment. Two lines of effort are clearly indicated. At the present time the greatest promise of success is held out by the surgeon. The second line of effort lies in investigation of the basic facts of cancer, how it is inherited, its method of dissemination, its causes and the measures for its relief. He reproduces an inquiry blank sent out by the life insurance companies to physicians for information that will assist in carrying out these researches.

ORGANIZED HYGIENE.

METHODS AND RESULTS IN INSTRUCTION IN PERSONAL HYGIENE—THE PROSPECT OF IMPROVING THE EXPECTATION OF LIFE IN MIDDLE AGE.

EUGENE C. HOWE,
Dept. of Hygiene, Wellesley College; Dept. of Biology and Public Health, Massachusetts Institute of Technology.

A LONG-STANDING criticism on the part of business men, directed against the business college and departments of similar function in universities, is that such institutions teach the adventitious methods rather than the salient problem of business. For instance, work may be offered in banking, in accounting, in business law, in transportation, or what-not—all convenient adjuncts and methods in business. But the nub of business really is "*to know how to make things and sell them at a profit.*" This should be the ultimate result of business training.

In the professional world as well as in the realm of business training too often the emphasis upon method and results is improperly apportioned.

Can it be said that a clear differentiation between means and end has been kept in view in the relation between sanitary and hygienic science and their proposed product—health? Certain methods have been developed by sanitary science, and certain results for health in the bulk have been accomplished by their use. There are certain methods of spreading the knowledge of personal hygiene, and certain results should be expected for enhanced individual vital preparedness. To what degree has there been clear insistence either in public health work or in instruction in personal hygiene upon results that can be seen, known, and measured?

It would, of course, be supererogatory to review in detail the methods and results of sanitation. The development of a sanitary science is an achievement that needs no heralding. Its results, the increase of the average length of life by reduction of the death-rate at all age periods, are clean cut and constantly in the foreground of the public mind. The reason for its success lies in the phrase, "Sanitary Science." It is a *science* and has progressed by experiment and generalization, and by the expression of its results in quantitative terms.

But to say that sanitation has succeeded in reducing the death-rate at all age periods is not, apparently, strictly true. What can be truly said is that the bulk of its success along its own proper lines has now been achieved.

Where sanitation has apparently failed, as shown by certain interesting and suggestive statistics, has been in

connection with the increasing death-rates between the ages of forty and sixty in this country. This important phenomenon has, of late years, been the subject of keen analysis and discussion. It appears that these are the ages where degradative changes in circulatory and excretory tissue, resulting from careless management of the human mechanism in youth, are likely to culminate. To sanitation, therefore, whose proper sphere has in the past included the prevention of infectious disease, the fault of failing to prevent these "wear-and-tear" diseases cannot be ascribed, except as the latter's etiology may include microörganisms as well as abusive treatment of the human machine. Nevertheless, boards of health, seeing new responsibilities before them, have turned resolutely to the problem of extending their influence to include this enormously difficult proposition of inculcating the principles and habits of personal hygiene among the general population with whom they deal. In other words, in addition to their heretofore customary task of regulating man's parasitic environment, of shielding him from his microscopic enemies, they now undertake to teach him to increase his physical stamina, to strengthen his body defences.

But why should public health agencies feel it encumbent upon them to enter this field of hygiene propaganda in the schools and in other community organizations? Has no other agency, these forty years, been entrusted with the task of developing a physical morale of living, of conducting a campaign planned to form a junction with the operations of boards of health?

There have been, of course, the schools in which the young idea with its "physical basis" has been supposed to receive instruction and training in vital fortification. Such instruction has, for the most part, been given sometimes by the grade teacher and the teacher of biology in the high school, and sometimes by a special class of teachers of nondescript standing (speaking of the country and the past thirty or forty years by and large) called variously teachers of Physical Culture, Physical Training, Physical Education, "Gym Teachers," etc.

In regard to the quality of instruction given by the regular staff teachers, it would seem needless to add to the existing number of despairing criticisms. Suffice it to say, in summary, that it has in the main been ineffective for three principal reasons. First, it has been too often preaching, instead of teaching. Second, it has usually been unsound. Third, it has been largely hypocritical. It should be added that such criticism should be considered directed, for the most part, for reasons that will appear later, against the "system" and administrative authorities, rather than against the personnel of the teaching force.

What of the special teachers of physical training? Theirs has been the special task, from the nature of the inception of their work, of raising the level of the individual's and so of the nation's vitality. Have they suc-

ceeded? One might say that the striking increase in the death-rate from all causes but especially from organic disease at the middle and later age periods in this country as compared with the decrease in European countries answers the question in the negative. For thirty or forty years the teachers of physical training have been performing their duties in the schools, and the young population coming to maturity has shown increasingly the circulatory and excretory defects which correct personal hygiene and good habits of exercise are supposed to forestall.

Let me hasten to add that this is to be considered a tentative suggestion only, as few would be so rash as to suggest that amid the flux of conditions in a new country (swamping immigration, movements in and out of the registration area, etc.) any one condition can be singled out and taxed with such a failure. This professional group, the teachers of physical training, may by their efforts and in spite of heavy handicaps have ameliorated the failure. There is no way to prove that they have not.

On the other hand, there is nothing to show that they have. They have kept no books,* proposed or made no extensive, sustained health surveys upon which to base their claims for public support. It has remained for vital statisticians to discover the deplorable gap in expectation of life at the half-way age groups, and it has been the boards of health, insurance companies, social workers, and medical inspectors of schools who have suggested health surveys to record the effects of training in personal hygiene, and to be a practical guide to further development of that work.

Sanitary science has had its up-hill road to travel, its period of small beginnings, obstructions of politics and ignorance to surmount. If influences outside what has been heretofore its accepted field have interfered with attainment of results, it has made it its business to control those influences. Thus it has spread to cover bacteriology, chemistry, entomology, engineering, statistics, education, medicine, and politics. It has made no excuses, but has presented its books for public auditing showing a balance on the credit side.

One cannot, after all, escape the suspicion, based on these much discussed figures for the death-rates at the middle age periods, on the absence of other statistics to show the precise effects of the teaching of hygiene in the schools, and on inexpert observation, that the teachers of hygiene and of physical training have, perhaps, been teaching classes,—not creating health. They may have been engrossed with method, and may not have been "making goods and selling them at a profit"—for the school child. If classroom work, no matter how "perfect" the technique or how "correct" the principle, does not produce the results in increased living and working capacity, then there is no excuse for not so altering it, so extending its correlation with other agencies of health work,

*F. L. Hoffman. "Statistical Evidence of Physical Progress or Deterioration of School Children." Eighth Congress of the Am. Sch. Hyg. Asso., San Francisco, June, 1915.

so enlarging the influence of personal example that it shall produce recognizable results.

But, it may be said, that hygienic results form only one phase of the work of physical training; that the latter is on a higher pedagogical plane; that it is concerned primarily with properly building the essential elements of action into the child's physical-mental-moral self,—with "fundamental education."

Such dilatory hair-splitting over definition ("speaking feelingly on the higher aspects") is merely one of the dead weights which submerge the teacher in method, out of sight of results. The question as to whether hygiene includes education, or education shall swallow hygiene is precisely as important as the question, "which came first, the chicken or the egg." It matters little whether hygiene be called a phase of education (and the pedagogy of heart, lungs, and liver be injected into the discussion of education in its historic sense, if that seems to anyone to be a suitable and logical classification), or education a phase of hygiene, if results are on record from whichever angle the matter is viewed. It matters less if it turns out that the results in either case overlap, almost to the point of coincidence. What are the desired results of education?

It were a venturesome amateur who should enter glibly into a discussion that began with the beginning of history, has filled libraries, and which approaches its termination as a limit. However, for tentative purposes: education is an evolution of the human being resulting, under given conditions of inheritance, in a useful, long, and happy life. Hygiene is the material science of organic efficiency that complements education and increases the probability, for the average individual, of usefulness, longevity, and happiness.

There is no desire or intention to monopolize under the title "hygiene" every activity of the profession of physical education that can be coaxed to show even the slightest trace of hygienic squint, nor, on the other hand, to establish a pedantic and unprofitable aloofness of hygiene from the education-hygiene complex. Surely, let there be physical educators with high ideals, and mature and scholarly knowledge of their Mulcaster, Locke, Froebel, and modern educational theory. Let them formulate the special psychology and ethics of gymnastics and play. Let physical education prove the connection in actual fact, as it is doing in certain directions, between the training it gives and the personality of its teachers on the one hand, and on the other hand lives of concrete usefulness in thought and action. But what must be thoroughly deprecated is the tendency to merge with non-scientific, qualitative, philosophic method of education, such things as the "education of the viscera" (viz., personal hygiene) which may be more profitably studied by the method of exact science and the results of which expressed in cold statistics. Education and hygiene are complemental and interpenetrating in aim and ultimate results. But they differ in that the methods and expression of results

of the latter are quantitative and scientific. Such quantitative expression of results the community is coming to demand.

Although sanitarians are alive to their obligations to strengthen human vigor in the middle age periods, it cannot but be observed that as they tackle the problem they are unable to shift their habitual attitude of attention solely to the prevention of disease to an attitude of constructive attention to health. More effective "school hygiene" is their aim, but, scrutinized closely, their "school hygiene" is seen to be a congeries of medical inspection and school sanitation—the book-keeping and janitor service of hygiene. It is not to be denied that medical inspection and school sanitation are in urgent need of improvement and standardized direction at the hands of the only agency that is qualified to improve and direct them—boards of health. But it is an error to suppose that these things constitute the strategic points of the campaign. Accurate and well organized accounts are indispensable as methods in successful business. They are lubricants and ergometers of the business engine but "making goods and selling them at a profit" is the steam in the boiler. Likewise making health by effective teaching and by the development of persistent habits of exercise and diet is the major objective of school hygiene.

Improved medical inspection of schools, school clinics, school sanitation, etc., are sure to come as *modi vivendi* are developed between boards of education and boards of health. The wind of popularity is blowing in that direction. The papers are full of "decayed teeth," "adenoids," "myopia," and "spinal curvature." What may come much more tardily and what is essential for the school child's benefit is, first, coöperation between the various agencies that are now working independently for his healthy development, and second, improvement in the quality of instruction in hygiene. It avails little for the self-supporting newsboy to be told to avoid wet feet, not to try to carry loads beyond his strength, to sleep out of doors, to partake only of appetizing food amid pleasant surroundings, and to be serene, if social and economic conditions clearly show the advice to be farcical, and if no follow-up work succeeds the instruction. It avails little if latent or possible foci of infection are sought out by medical inspection, if no effective teaching of personal hygiene accompanies and follows inspection. Instruction in personal hygiene is of negative value if it is not backed up by the personal example of the instructor and if its effects are not checked up and verified in the vital statistics of school and country.

How to accomplish the coöperation between board of health, school administration, social service organization, etc., in respect to this particular problem? This is the type of question, the answer to which, in words, does not exist. But it must be eventually answered in practice, and is so being answered in some communities, in spite of conflicting spheres of admin-

istration. However, past experience in the sharing of authority in medical inspection has been so painful that one hesitates to visualize the situation when school superintendent and health officer "coöperate" in hygienic instruction.

Improvement in the teaching of hygiene is bound up in the question of coöperation. But the ill-advised and hasty entrance of public health authorities into the field is not sure to prove an unmixed blessing. There must be real coöperation: a cordial willingness on the part of public health administrators and educators to learn each other's lines of work and accept each other's judgment in the special field of each. Poor as has been the teaching of personal hygiene, it does not at all follow that matters will be improved by the substitution for the present teaching methods of wholesale hygienic evangelism and other vagaries of medical officers.*

How to accomplish improvement in instruction, long delayed in spite of frequent criticism? Here again any brief answer may be an "explanation that does not explain." However, this can be said, which has the virtue of obvious truth if not of a complete, practical solution, that the grade teachers and teachers of biology in the high schools should possess sound and uniform teaching material; second, that they should set a creditable hygienic example; and third, that they should have a professional spirit which will seek results, if necessary, through correlated interests and by many means outside their regular teaching routine.

But the limits of the grade and high school teacher in assimilating special subjects are all but reached? There is, then, the special corps of teachers of physical education whose special function is now education by directed activity. Proper habits of activity, in view of modern cheap transportation and the thousand and one substitutes for muscular activity that modern invention seductively offers,

*"The writer has been employing the case system in teaching hygiene and preventive medicine during the past two years in public school work. In using the case system to teach hygiene and preventive medicine, the teacher at the start of the lesson distributes to the pupils records of specific cases of disease and disorders which occur commonly in everyday life. The cases are given out just as they occur in life, *i. e.*, the diagnosis, the prognosis and treatment are not given away but must be thought out by the pupil. The teacher is given a teacher's edition which consists of three things: (I) the subsequent history of the case setting forth the diagnosis, outcome and treatment; (II) a list of objects that the case is designed to accomplish; (III) an outline of practical and scientific facts used to teach the lessons designed to accomplish the objects.

"As an illustration the following case was given out:

"'Michael P., aged thirty-two, a motorman, had been working at his occupation about six months when he noticed that the veins in his legs were getting large. In six months more they were very large and there were more of them. At the end of two years he had masses of large, hard, knotted veins on both legs and up the inside of the thigh. The pain in the veins often kept him awake at night. In speaking to a friend about it, his wife said that he was troubled with 'very coarse veins.' While driving his car through heavy traffic down-town he felt a sharp pain and soon his foot felt wet.'

"The pupils were given three minutes to read it over and decide in their own minds the answer to three questions: (I) What is the trouble with the man? (II) What is the outlook for him? (III) What would you do? . . . In a like manner the entire fields of hygiene and preventive medicine are covered. Many of the cases are about the prevention of things in which the child is immediately interested. . . . In this instance, the children in the sixth grade made a diagnosis of hemorrhage and varicose veins without being told."

Quotation from "The Case System of Teaching Hygiene and Preventive Medicine in the Upper Grades." H. W. Haight, *Ed. Rev.*, N. Y., May, 1915.

constitute the chiefest of the three or four chief divisions of the subject of personal hygiene. Therefore, upon these teachers, the responsibility logically rests of creating effective methods of instruction in personal hygiene—instruction which is scientifically sound, which is strengthened instead of nullified by personal example, and which "engages" with the other cogs (school sanitation, medical inspection, etc.) in the machine of organized hygiene.

This is not a new suggestion. It was made twelve years ago by Sedgwick and Hough,* and by Hough,† with an insight and with a convincing power of expression that have not been approached in any subsequent discussion of the subject. That it has not borne fruit is shown by the fact that, of the graduates of one of the normal schools of physical education of high standing, the number called to positions involving the formal teaching of personal hygiene has been during these eleven years only *one per cent.* of the total number of graduates in that time who are now actively engaged in the profession.

That the leaders in the profession of physical education appreciate the situation in theory, is easily seen. Storey says, "The objects of school hygiene and physical education are identical . . . we believe that this broad field belongs logically to us." Meylan, "The teaching of hygiene belongs normally to the department of physical education." Sargent, "Physical training in its best sense is nothing but applied physiology and hygiene."

What, then, have been the causes for the actual apathy toward Hough and Sedgwick's proposition. First there has been the demand of school administrators for the traditional type of teacher. Second, the tendency of the normal schools of physical education, many of them privately financed, to supply this demand rather than to venture to create a demand for broader types. Most normal schools, to be sure, have introduced into their curricula courses in "school hygiene" and cognate subjects, specific in name but too often vague in content, sometimes with the intent of really rising to the new situation, sometimes for appearance's sake. But the weight of relatively unchanging demand has crushed all vitality from such courses, and from the course in personal hygiene, and left them emasculated forms, considered by the students to be devoid of any possibility of application in their future work. The third cause of absence of response to Hough and Sedgwick's proposal has been the heterogeniety of standards of admission, content of curriculum, and requirements for graduation of normal schools of physical education.

Summarizing thus far and concluding: boards of health are seeking ways of gaining influence over the personal hygiene of individuals; of extending

* Sedgwick, W. T. and Hough, T. "What Training in Physiology and Hygiene May We Reasonably Expect of the Public Schools." *Science*, N. S., XVIII, 455, Sept. 18, 1903, pp. 353–560.

† Hough, T. "On the Correlation of the Work in Physical Training with Instruction in Personal Hygiene." An address delivered before the Physical Education Society in Philadelphia, Jan. 24, 1903. Reprinted by the Boston Normal School of Gymnastics, now the Department of Hygiene, Wellesley College.

their work beyond the limits of prevention of infection.* An important fulcrum for getting a purchase on the problem is this hygienic training in the schools and other social and educational organizations. There, most effectively, may the youth and their parents be reached. It is doubtful if health officers in this country, following their traditional bent, will do otherwise than what has already been done, carry sanitation and preventive medicine into the schools and label it "school hygiene." Improvement in school sanitation and school statistics is to be desired and must be secured. But more important is effective *teaching* of personal hygiene. Such teaching should naturally be expected to center in the teachers of physical education. Theirs is now the function of directing the instincts of physical activity into permanent channels, and such direction and regulation of exercise is four fifths of the teaching of personal hygiene.

The organization of teachers of physical education already exists. To improve and use an existing organization is, as Hough and Sedgwick pointed out in connection with this particular situation, axiomatically more economical than creating new machinery for the manufacture of health in the school.† The reorganization of physical education in scope and methods is a problem in itself.

A large majority of teachers of physical education and trained supervisors of school hygiene and sanitation should come from public normal schools, and colleges and universities. No criticism is necessarily implied of the quality of work of institutions now under private control. But it is believed that a stronger, better balanced situation will exist when their work has largely passed under the

*"As medical inspectors we should take a comprehensive view of educational hygiene. It is perhaps true that the amount of detail involved in systematic medical inspection, 'following up,' and treatment tends to mask the larger issues. But while we inspect and treat, we should also think of the means within our power by which we may be able to build up the physique and resistance of all school children.

"It has fallen to the lot of educational authorities to supervise and to some extent to contribute to the physical well-being of all school children. All the factors falling within such an undertaking should be correlated, controlled and directed by the medical officer. It is only reasonable that efforts to detect and cure disease and physical unfitness should be accompanied by efforts to prevent such disease and physical unfitness.

A broad general system of constructive hygiene should form the basis of the entire work of the school medical inspector. It is needful to guard the health of the normal child quite as much as to seek out and remedy the disease of the abnormal child. . . . The child and not the disease should be the main point of interest. . . . "

Mackenzie, W. L. and Cruickshank, L. D. (Eds.) "Problems of School Hygiene, being a rept. of the first conference of Scottish School Medical Officers." Edin. and Lond., Wm. Hodge & Co., 1914.

†" . . . the medical officer will naturally seek out and utilize to the best advantage schemes that aim at improving the physique of all school children. One such scheme already exists in physical training. This subject already forms a part of the curriculum of every school. It is already sufficiently organized to form an excellent basis for the development of a more comprehensive scheme of physical education.

"Physical education is finding its true place in the school curriculum rather slowly. This is perhaps due to some extent to the want of a clear conception of what is aimed at, and of a careful consideration of the means by which the end is to be attained. Personally I feel that until this subject receives from the medical officers the serious attention that it merits, its development as a school subject will be slow and unsatisfactory. . . .

In short, physical education is a largely unexplored field so far as it affects the hygiene of youth, and the time is ripe for a carefully considered series of investigations and experiments on its true place in hygiene education. . . .

"It would be difficult, almost impossible, to efficiently correlate to the extent I have suggested medical inspection and physical education; but I think it must be apparent to those who have given serious thought to the matter that this blending of two mutually dependent branches of work is highly desirable."

Mackenzie and Cruickshank, *loc. cit.*

direction of state boards of education and corporations of colleges.

As has already been suggested, a curriculum may be devised that will give in fact as well as in name the training that will lead to results: in brief outline, as follows:

I. An adequate foundation of science, mathematics, physics, chemistry, and biology, and of modern languages.

II. That great class of material, already carefully elaborated—gymnastics, informal exercise, posture development, the pedagogy and ethics of physical training, special anatomy and physiology.

III. 1. Theory and *practice* of teaching personal hygiene.

2. The principles of bacteriology, immunity, and preventive medicine.

3. Sanitary science.

4. Medical inspection of schools (to make possible assisting in such work).

5. Symptomatology.

6. Vital statistics.

In all courses practical problems should be covered in the laboratory work. There should be sanitary surveys of school establishments, visits to board of health laboratories, practical work in assisting in school medical inspection, exhibits of outfits sent out by public health laboratories, and of the literature, cards of instruction and notification, test charts, blanks, etc., that are distributed to teachers in those states and cities farthest advanced in school medical inspection.

For those who wish to qualify for eventual work of greater responsibilities, there should be courses leading to advanced degrees, in combination or not, with medical training.

The work of this class of teachers would include, first, physical education and instruction in personal hygiene, and supervision of the regular teachers in both regards. Second, owing to their strategic intermediate position between the untrained regular teacher and the trained itinerant health officer, it is specifically fitting that they should coöperate with both in the detection of structural defects and incipient infection, and in overseeing the general sanitary condition of the schools. Their expert training in physiology, hygiene, and sanitation combined with a professional constructive attitude in matters of hygiene can never be duplicated by the school nurse, important as are her duties. The absence of all medical bent is a distinct point in their favor.

Such a nucleus of trained teachers and directors of school hygiene, using the phrase in its best meaning, by teaching methods which are pointedly effective, but broad and coöperative, and by their appreciation of and ability to measure the results they are seeking, should be expected to leaven the whole lump of hygienic instruction in schools and other organizations—Christian Associations, Boy Scouts, clubs and societies of older men and women, and the military training camps of the near future. It should be an integral driving part in the new machine of *organized hygiene*—a machine whose specific manufactured product is to be improvement in the expectation of life and increase in working capacity at the middle age periods.

Such a broadening and deepening of the function of the teacher of physi-

cal education cannot be expected from the normal schools unassisted. They have heard the call, these twelve years or more, and have been unable to respond in practice for reasons already mentioned. When a demand comes from a school administration handling twenty thousand children, for three teachers of physical education to supervise the work of five hundred teachers in gymnastics and dancing, teachers must be furnished who are intensively qualified to drive through so much routine under high pressure. It is not practicable, before the education of school administrators has reached a more enlightened level, for the normal school to press the alternative on the employers who apply to them, of hiring several times that number of teachers of *hygiene* who can supervise the gymnastics, and play, but who are also broadly qualified to teach and to supervise the teaching of personal hygiene and to assist in medical inspection and school sanitation. When the broader demand comes, the normal schools will be able and eager to meet it. To create such a demand in the mind of the educational system is an obligation upon public health officers and physical educators. To insist that graduates of normal schools of physical education be qualified to carry their full share in the coöperative work in hygiene of the future is the duty, if the plan is a sound one, of public health officers and educators.

PLAYING TO THE GRAND STAND.

"Grandstander" is a term of more than mild reproach used to characterize the athlete who plays his game in showy fashion with an eye to the plaudits of the onlooking multitude. In football, he is always limping after a tackle; in baseball, he is excessively active, making unnecessary motions and attempting to cover ground he was never meant to cover; in golf, he adjusts his tee with a nicety which can have no effect on the distance of his drive, and if he "slices," the "gallery" is indulged with an exceedingly technical discussion of just how it happened. No one is so inclined to "grandstand" as the American officeholder or public official. The medical aspects of the matter are being displayed in the present epidemic of infantile paralysis. The measures employed by some officials to stay the progress of the epidemic, while apparently logical in every instance, at times impress the average observer as being merely an attempt to play to the grandstand. In some communities the health officers appear daily in interviews in which they call attention to their immense activities in preventing the spread of the disease. Every move is chronicled in the newspapers, and press notices are sent to those papers which fail to interview the official personally. Commissions are appointed to investigate when there are no funds for such purposes, and in some instances when there are not enough cases to form a respectable basis for an investigation. Frequently a "grandstander" in athletics is rewarded merely by the hisses of those whose encomiums he seeks. It would not be strange if a similar fate should befall some of those public officials who carry the unsportsmanlike attitude of the "grandstander" into the care of the public's health. —*Journal of the American Medical Association.*

A STUDY OF METHODS FOR DETERMINING AIR DUSTINESS.

GEORGE T. PALMER, LAURENCE V. COLEMAN, and HARRY C. WARD.

An Investigation Conducted under the Joint Direction of The New York State Commission on Ventilation, The American Museum of Natural History, and The American Museum of Safety. 1915–1916.

To be read before the Laboratory Section of the American Public Health Association, Cincinnati, Ohio, October 24-27, 1916. Received for publication September 1, 1916.

INTRODUCTORY.

THE excessive prevalence of tuberculosis and other respiratory affections among the workers in dusty trades is amply demonstrated by statistical data. In order to obtain a clearer understanding of the amounts of aerial dust that are harmful and hence help to allay the dangers of dusty occupations through the medium of regulations bearing on personal hygiene and protective devices, it is essential to study by analytical methods the dust content of the atmosphere. Numerous procedures have at various times been proposed but the very diversity of these methods has made the comparison and the interpretation of analytical results most perplexing. Furthermore some procedures are very limited in their application. It has been the purpose of the present study to inquire into the merits of certain of the most promising methods with the idea of selecting one which can be recommended as a standard method for ordinary ventilation investigations.

METHODS THAT HAVE BEEN USED FOR DUST DETERMINATION.

Without entering into too great detail there may be listed here some of the dust analysis methods which have at one time or another been followed:

1. Exposing oiled plates to the air for a definite time, washing the plates with oil and comparing the color with dust and oil standards. This method is mainly applicable to soot and smoke (Liefmann) (1).

2. Revolving a syrup covered paddle wheel in the air and noting the resulting discoloration of the white blades.

3. Drawing a measured amount of air into a small chamber and rarifying the medium thus causing a deposit of moisture on each dust particle present. The intensity of the fog created is then compared with translucent glass standards (the Koniscope-Aitken) (2).

4. A modification of the Koniscope; the dust particles in this case being caught on a glass slide and the moisture droplets counted (Dust Counter-Aitken) (3).

5. Passing a measured amount of air through a cylinder in which is inserted a shallow dish, coated with glycerin. As the air stream is propelled against the dish, the heavier dust particles are caught on the glycerine, the air and lighter particles passing on around the edge of the dish.

The particles on the plate are counted with the aid of a microscope (Graham-Rogers) (4).

6. Suspending a container of water in the air for several weeks and then weighing the accumulated dry solids after filtration. This method was used to determine the prevalence of dust in different sections of a city (Whipple and Whipple) (5).

7. Filtering a measured amount of air through paper, mixing the residue with oil and comparing the color with dust and oil standards. This method was used for the determination of soot (Rubner) (1).

8. Filtering a measured amount of air through cloth and comparing the discoloration with a set of cloth standards (Todd) (6).

9. Filtering a measured amount of air through collodion wool, dissolving the wool in ether and counting the particles in a small quantity of the liquid (Hahn) (1).

10. Filtering a measured amount of air through sugar or resorcin, dissolving in water and counting the particles in a small portion of the sample (Winslow & Baskerville (7), Lanza (8)).

11. Filtering a measured amount of air through fine mesh wire cloth with subsequent bubbling through water and then determining the weight of the solids collected. This method was used for determining the dust in flue gas (Klein) (9).

12. Filtering a measured amount of air through cotton wool and noting the increase in weight (Duckering (10), Ditman (11)).

13. Filtering a measured volume of air through Soxhlet paper thimble and noting increase in weight (Mariner and Hoskins) (12).

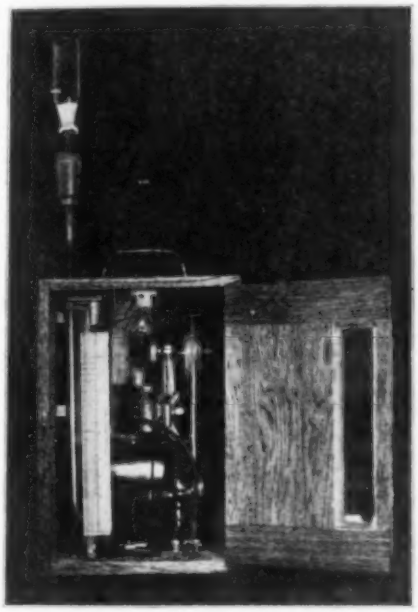
In addition it is also of interest to mention several devices which have been constructed involving in some cases certain principles which do not appear in the foregoing list.

One of these is a centrifuge which Wells of the U. S. Hygienic Laboratory used with some success in sampling bacteria. The whirling of a cylinder with extended tubular arms on a vertical axis causes a current of air to pass down an aperture at the axis into a glass tube whose walls are lined with agar or gelatin, and thence to pass up and out through the tubular vanes. The centrifugal action and the lessened velocity through the glass tube causes the suspended matter to precipitate against the walls. The subsequent incubation of the tube permits a growth of colonies where the individual bacteria have alighted and these colonies are readily counted with the naked eye.

A modified form of the above device involving the centrifugal principle but with greater air capacity was devised for the Commission by Wallace & Tiernan, of New York City. This apparatus had a metal bowl of eight inches diameter and 6 inches in height whirled by a direct connected motor mounted on a verticle shaft. The entire equipment weighed 38 pounds. So many difficulties developed in the use of this apparatus such as the varying motor speed, the difficulty of removing the dust from the interior of the bowl, together with its general cumbersomeness, that further

experimentation with it was not deemed expedient.

The precipitation of dust from flue gas onto a high tension pole has proved useful on a practical scale. A potential of 40,000 volts is necessary for this action. The application of this principle to the sampling of small quantities of dust has been the object of some study by Doctor Macmillan of the New York City Health Department.



Sugar Filter with Wallace & Tiernan Air Pump.

The luminosity of dust particles in a strong beam of light is familiar to every one. The authors endeavored to construct a device which would permit the direct counting of the particles on a light beam but this did not prove successful. An extension of this idea involving the photographing of the luminous particles seen at right angles to the light beam was given some little attention by one of us (Coleman) but the difficulty of preparing standards for comparison and the elaborateness of this procedure discouraged continued effort.

Discussion of the Principles of Dust Determination.

It is impossible in the short space of this paper to enumerate the advantages and shortcomings of each of the procedures which have been described. It will be sufficient to touch briefly upon the underlying principles of sampling and estimation involved.

The determination of the dust content of air consists of two steps (1) sampling and (2) measuring the quantity of dust in the sample. The methods cited may be classified readily under two main processes of sampling, viz., precipitation and filtration. The measures to be employed once the sample is collected include (1) noting the cloudiness of the sample, or the turbidity if suspended in a liquid, or noting the color or discoloration of a dry filter pad; (2) weighing the mass; (3) counting the particles in an aliquot portion of the sample.

1. *Sampling by Precipitation.*

Sampling by centrifugal and electrical precipitation has not been sufficiently developed to receive comment. Precipitation by gravity as illustrated by Method No. 6 proved very successful for the particular study before the Whipples, but the long time necessary to secure a weighable sample renders this method un-

suitable for ordinary building inspection work.

Precipitation, as illustrated by the Graham-Rogers plate, collects but the larger dust particles, and as it is these larger particles which are probably more dangerous to the mucous membrane the originator of this method believes that what is apparently a weakness in this method is really an advantage. With this sampling method, however, the estimation of the quantity of dust is limited to counting.

Precipitation of moisture on the dust particles by rarification of the air, a principle developed by Doctor Aitken in the Koniscope and the Dust Counter, may be criticized because of the smallness of the sample measured. Further objection is found in the subsequent methods of measurement. The fog of the Koniscope is difficult to standardize in absolute units and the size of the dust particles is entirely lost sight of in the dust counter for each infinitesimal particle collects its moisture droplet and is thus given equal weight with the large particles in the resulting count.

2. Sampling by Filtration.

Filtration is as a rule a slow process depending, of course, on the fineness of the filter. The smaller the mesh the greater is the resistance to the air flow and hence the longer must be the sampling time. The coarser the mesh, however, the less is the efficiency of the dust removal. It is in the proper balancing of these two factors that the success of any filtration method must rest.

GRAHAM-ROGERS PLATE.

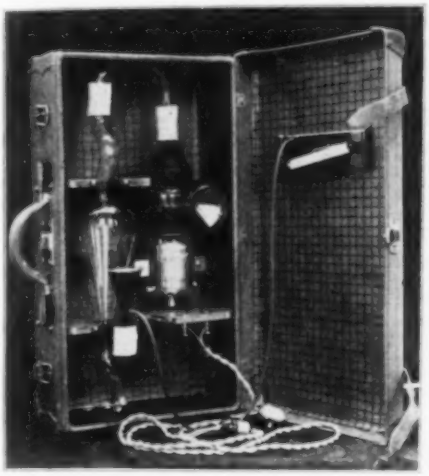
The dish, shown in the hand, rests on the support within the glass cylinder during the taking of a sample. Air entering the cylinder through a small hole in the stopper, is drawn down past the edge of the plate and leaves the cylinder through a glass tube at the bottom.

The wire mesh screen is suitable only where great quantities of dust are present as in garbage reductor stacks. The cloth filter collects only the larger particles of dust and this amount must be estimated by discoloration rather than by weighing. Those particles whose color is most sharply contrasted with that of the filter may influence the final result much more than particles whose mass may be greater but whose color is less conspicuous.

The heavier paper pad is more efficient in removing dust but its lesser porosity cuts down the rate of sampling. The weighing of a sample collected by this means is interfered with by the excess moisture in the filter itself. The actual weight of dust is determined only after tedious

drying of the filter to constant weight before and after sampling.

The soluble filtering media-collodion wool, sugar, resorcin are used usually in conjunction with subsequent estimation by counting. In addition to the limitation upon the size of the sample imposed by the resistance of an insoluble pad there is also associated with this method an error due to the inevitable dust content of the filtering material itself. The size of this error is not easy to estimate and hence it is difficult to make accurate allowance for in the total dust count.



WATER SPRAY SAMPLER.

Showing air pump and glass sampling bulb, air measuring tube over inlet and indicating manometer.

The use of water as a filtering medium is a slow process if the air is drawn through in bubbles, and, unless the bubbles are small, dust is apt to be entrained and pass through untouched. When, however, air is passed through a spray or curtain of water, high efficiency is possible with very little resistance. Furthermore, by sampling large volumes of air in this manner it is possible to determine the weight of dust as well as the count and turbidity.

This last procedure has received very thorough investigation by the authors and was described by one of us (Palmer) at length in the issue of the AMERICAN JOURNAL OF PUBLIC HEALTH for February 1915 (14).

THE MEASURING OF DUST.

When the dust content is observed directly as in the beam of light the sampling process is eliminated. Shortening the procedure in this manner is a point in its favor but very little has been done along this line.

Estimating the dust content in a sample by the *color* or *discoloration* produced is much the simplest method of estimation once the standards are prepared but this method is very limited in its application and is open to grave objections as already mentioned. It is impossible in this way to compare amounts of dust unless their color and texture are identical. This colorimetric method is peculiarly suitable for the determination of soot and smoke, but it is not suitable in comparing amounts of dust from different factory processes. Again, the preparation of the standards is not a simple task for there should be a separate set of standards made up from each type of dust to be measured.

Weighing is a more exact procedure but the extreme lightness of dust makes it imperative to sample large volumes of air in order to yield a weight of dust that is within the sensitiveness of the ordinary laboratory balance. Weight,

however, merely gives a picture of the entire mass. It fails to tell us anything of the size of the dust particles, information which is of no little value when comparing different types of dust.

Counting with the aid of the microscope permits, as does weighing, the expression of the result in absolute units. Counting, however, is a laborious and often a gravely inaccurate procedure. It is sometimes very difficult indeed to discriminate between a dust particle and irregularities in the glass slides. As the number of dust particles floating about is very great even in air which may seem exceptionally clean, it is only possible to count the dust in a very small portion of the sample. The amount in the whole sample is then obtained by a conversion factor. If this conversion factor is large then errors in the count are magnified. Because of the difficulty then in counting accurately and in making an accurate allowance for the constant error of dust in the filter and on the slide, it is essential to make the conversion factor as small as possible and this is best done by making relatively large the volume of air sampled.

The number of particles in the field also influences the accuracy of the count. A sample with relatively few particles, less than 10 per quarter field, will be counted with greater accuracy than a sample having several hundred to a quarter field.

The count by itself tells but one story of dustiness as does weight by itself. Both are needed for the interpretation of air dustiness. The fine lint floating in a carpeted room would have a high count but would weigh little. In direct contrast is an atmosphere laden with marble dust. Here the count would be relatively much smaller than the weight.

Part I.

Methods Selected for Study.

After considerable preliminary experimenting guided in a large measure by the recommendations of the Committee on Standard Methods of Air Analysis of the American Public Health Association as described in the report for 1912 (4), it was decided to make a direct comparison of three sampling methods which seemed to possess certain distinct advantages over other methods. The three in question included the sugar filter operated in conjunction with the Wallace & Tiernan pump; the Graham-Rogers plate, also operated with the above mentioned air pump; and the water spray filtration apparatus (see photographs).

Technique.

The procedure consisted in setting up the three types of apparatus side by side and collecting air samples at approximately the same time. This plan was the fairest that could be arranged but it must be borne in mind that even under these conditions the air sampled by each machine was, of course, not identical. The opening of a door or a window or the passing about of people would at times give rise to air currents which in the opinion of the observers caused some

variation in the dust content of the air drawn into the different machines. Furthermore the sampling time for the first two methods was 12 minutes, three cubic feet being pumped. As but one pump was available, these methods could not be operated simultaneously, but had to be taken in turn. The water spray sampler passed 3 cubic feet in 1 minute.

Attention is drawn to these various possibilities for legitimate difference in the final result not so much to excuse the irregularities that occur as to make it clear to the reader that the accurate sampling of air is a difficult matter. It is quite another thing from the sampling of water for a bacterial count, for water is much more homogeneous than air and the distribution of suspended matter and chemical constituents is much more uniform.

The sampling places included a hat fur factory, a burlap-bag factory, a rag sorting shop and a pearl button factory. The dustiness of these places of course varies from day to day and from hour to hour depending on the particular work then in progress.

The ordinary routine consisted in devoting the mornings to sampling and then returning the samples to the laboratory and carrying on the analysis there in the afternoon.

Owing to the limitations of two of the methods the comparative efficiency of these devices was to be based on the resulting count per cubic foot of air sampled.

The Graham-Rogers plate was counted directly under the microscope, the $\frac{2}{3}$ objective being used. Ten representative areas of equal size were counted and the average was multiplied by the number of such areas on the plate. The total count for the sample thus obtained was converted into the count per cubic foot of air.

The standard procedure was followed for each of the other two methods, $\frac{1}{4}$ field or 0.25 sq. mm. being the area examined. In counting, five sizes of particles were distinguished, viz:

1. Large masses about 100 standard units (.04 sq. mm.).

2. About 25 standard units (.01 sq. mm.).

3. About 1 standard unit (.0004 sq. mm.).

4. About $\frac{1}{4}$ standard unit (.0001 sq. mm.).

5. Dust too fine to count but whose presence is noted by a + mark.

This scale may seem somewhat arbitrary and unevenly graded, but its selection was based on some preliminary counting which showed that these divisions provided a convenient grouping for the eye and that more refined or evenly graded areas could not be readily recognized.

Analytical Data.

In Table I is presented among other data, a list of the samples collected, the amount of air sampled, the time of sampling, the average of 10 counts for each size particle per $\frac{1}{4}$ field, the actual average count per cubic foot of each size and the total count per cubic foot.

Eighteen samples were collected with the sugar filter, 21 with the water spray filter and 8 with the Graham-Rogers plate.

TABLE I.

Place.	Date.	Sampler.	Cu. ft. air sample.	Time minutes.	Av. of 10 counts per ¼ field (sizes.) 1.	2.	3.	4.	5.	Av. No. particles per cu. ft. of air by sizes. 1.	2.	3.	4.	Total count per cu. ft.	Dustiness.	Dil. water C.C.	Comments.
Hat fur	Aug. 9	Sugar	3	12	0	0	.6	43.1	+	0	0	12,000	862,000	874,000	V.D.	15	
			3	12	0	0	1.5	38.1	+	0	0	30,000	762,000	792,000	V.D.	15	
			3	12	0	0	.2	51.4	+	0	0	4,000	1,030,000	1,030,000	V.D.	15	
			Average 3	12						0	0	15,300	884,000	899,000			8,670 hair particles per cu. ft.
			% of total count							0	0	2	98				
		Spray	15	5	0	0	1	18.7	+	0	0	2,400	454,000	456,000	V.D.	90	Hair in bottle but not on slide
			9	3	0	0	4	21.2	+	0	0	16,000	848,000	864,000		90	
			Average 12	4						0	0	9,200	651,000	660,000		90	
			% of total count							0	0	2	98				
		Plate	3	12	0	0	.6	1.9	−	0	0	1,650	4,580	6,230	V.D.		No hair
			% of total count							0	0	26	74				
		Plate (Gravity)		12	0	0	.3	1.4	−	0	0	823	3,380	4,220	V.D.		No hair
			% of total count									20	80				
	Aug. 10	Spray	18	6	0	0	0	16.9	+	0	0	0	676,000	676,000	V.D.	90	4,000 hair particles per cu. ft.
			% of total count										100				
		Plate	3	12	0	.2	0	1.7	−	0	482	0	4,100	4,580	V.D.		No hair
			% of total count							0	11	0	89				
Burlap bag	Aug. 12	Sugar	3	12	1	2	1.7	31.2	−	2,000	4,000	34,000	624,000	664,000	D.	15	
			3	12	0	0	.5	19.0	−	0	0	10,000	380,000	390,000		15	
			Average 3	12						1,000	2,000	22,000	502,000	527,000		15	
			% of total count							3	7	4	95				
		Spray	11	3	0	0	.8	10.0	−	0	0	25,000	320,000	346,000	D.	90	
			20	5	0	0	.4	8.1	−	0	0	7,200	146,000	153,000		90	
			18	6	0	0	.4	10.6	−	0	0	8,000	212,000	220,000		90	
			Average 16	5						0	0	13,600	226,000	240,000		90	
			% of total count									6	94				
		Plate	3	12	0	1	.2	1.4	−	0	241	482	3,380	4,100	D.		
			3	12	0	0	.2	.7	−	0	0	482	1,690	2,170			
			3	12	0	0	.1	1.2	−	0	0	241	2,890	3,130			
			3	12	1	0	0	.9	−	241	0	0	2,170	2,170			
			Average 3	12						60	60	301	2,530	3,050			
			% of total count							3.5	3.5	10	83				
	Aug. 13	Sugar	3	12	0	0	1.5	51.4	+	0	0	30,000	1,030,000	1,060,000	D.	15	
			3	12	0	0	.5	47.0	+	0	0	10,000	940,000	950,000		15	
			3	12	0	0	.2	37.0	+	0	0	4,000	740,000	744,000		15	
			Average 3	12						0	0	14,700	903,000	917,000			
			% of total count							0	0	2	98				

		Spray	18	6	0	0	3	75 0	+	0	0	6,000	1,500,000	1,500,000	D.	90	
			18	6	0	0	1 6	99 3	+	0	0	32,000	1,990,000	2,020,000		90	
			18	6	0	0	5	52 5	+	0	0	10,000	1,050,000	1,060,000		90	
			Average 18	6						0	0	16,000	1,510,000	1,530,000			
			% of total count							0	0	1	99				
		Plate	3	12	0	0	3	6 9	−	0	0	724	16,600	17,300	D.		
			3	12	0	0	3	7 6	−	0	0	724	18,300	19,000			
			3	12	0	0	3	6 1	−	0	0	724	14,700	15,400			
			Average 3	12						0	0	724	16,600	17,300			
			% of total count									4	96				
Rag sorting	Aug. 19	Sugar	6	24	0	2	1 0	40 3	+	0	1,330	6,670	269,000	277,000	N.D.	10	
			6	24	0	1	9	52 5	+	0	666	6,000	350,000	357,000		10	
			6	24	0	1	6	47 9	+	0	666	4,000	319,000	324,000		10	
			Average 6	24						0	888	5,560	313,000	319,000			
			% of total count							0	0 3	1 7	98				
		Spray	60	20	0	0	6	14 6	−	0	0	3,600	87,600	91,200	N.D.	90	
			60	20	0	0	1 1	14 8	+	0	0	6,600	88,800	95,400		90	
			60	20	0	0	1 2	12 2	+	0	0	7,200	74,200	81,400		90	
			Average 60	20						0	0	5,800	83,500	89,300			
			% of total count									6	94				
		Sugar	6	24	0	1	7	20 9	+	0	1,000	7,000	209,000	271,000	N.D.	15	
			6	24	0	0	5	12 7	+	0	0	5,000	127,000	132,000		15	
			6	24	0	1	1 5	44 8	+	0	1,000	15,000	448,000	464,000		15	
			Average 6	24						0	666	9,000	261,000	271,000			
			% of total count							0	0 3	3 7	96				
		Spray	60	20	0	0	1 0	15 3	+	0	0	6,000	91,800	97,800	N.D.	90	
			60	20	1	0	4	23 8	+	600	0	2,400	143,000	145,000		90	
			60	20	0	0	4	21 0	+	0	0	6,000	126,000	132,000		90	
			Average 60	20						200	0	3,600	120,000	124,000			
			% of total count							0 2	0	2 8	97				
Pearl button	Aug. 25	Sugar	6	24	0	0	8	27 1	−	0	0	8,000	271,000	279,000	D.	15	
			6	24	0	1	5	24 6	−	0	1,000	5,000	246,000	251,000		15	
			Average 6	24						0	500	6,500	259,000	266,000			
			% of total count							0	0 2	2 8	97				
		Spray	36	12	0	2	7	10 4	−	0	2,000	7,000	104,000	113,000	D.	90	
			36	12	0	0	5	8 9	−	0	0	5,000	89,000	94,000		90	
			Average 36	12						0	1,000	6,000	96,500	104,000			
			% of total count							0	1	6	93				
	Aug. 27	Sugar	6	24	0	1	8	33 1	+	0	1,000	8,000	331,000	340,000	D.	15	
			% of total count							0	0 3	2 7	97				
		Spray	36	12	0	1	2	43 1	+	0	1,000	2,000	431,000	434,000		90	
			36	12	0	1	5	33 6	+	0	1,000	5,000	336,000	342,000		90	
			36	12	0	0	6	25 0	+	0	0	6,000	250,000	256,000		90	
			36	12	0	0	9	33 8	+	0	0	9,000	338,000	347,000		90	
			Average 36	12						0	500	5,500	339,000	345,000			
			% of total count							0	0 2	1 8	98				

Explanation of letters in "Dustiness" Column (Observer's Comment): N.D.=Not Dusty. D.=Dusty. V.D.=Very Dusty.

A scrutiny of this table reveals several interesting facts, namely: (1) the counts with the Graham-Rogers plate are very much lower than those from the other two samplers; (2) the bulk of the particles belong to Class 4; (3) the counts with the sugar filter are usually greater than with the water spray sampler; (4) the amount of air sampled is universally greater with the water spray sampler than with the other two methods.

In order to obtain a true measure of the relative efficiency of these three sampling methods there have been selected in Table II those records from the sugar filter and the spray sampler which are justly comparable—samples that have been taken at approximately the same time and in the same place. In 5 out of 7 instances the average count for the sugar filter is higher than for the water spray apparatus. Expressing the different averages as ratios, the sugar filter count being valued as 100, the average of the water spray counts is 71 per cent. (see Table II).

Selecting those figures where direct comparison is possible between the water spray apparatus and the Graham-Rogers plate as in Table III,

TABLE II.

COMPARISON OF AVERAGE COUNTS WITH SUGAR FILTER AND WATER SPRAY METHOD OF SAMPLING.

Place.	Date.	Sampler.	Av. cu. ft. Air sample.	Av. count. per $\frac{1}{4}$ field.	Av. count per cu. ft.	Ratio with sugar at 100%.	
						Sugar.	Spray.
Hat fur	Aug. 9	Sugar	3	45.0	907,000	100	
		Spray	12	20.2	660,000		73
Burlap	Aug. 12	Sugar	3	26.4	527,000	100	
		Spray	16	12.1	240,000		45
	Aug. 13	Sugar	3	45.9	917,000	100	
		Spray	18	76.4	1,530,000		167
Rag	Aug. 19	Sugar	6	47.9	319,000	100	
		Spray	60	14.8	89,300		28
	Aug. 20	Sugar	6	27.1	271,000	100	
		Spray	60	20.7	124,000		46
Pearl	Aug. 25	Sugar	6	26.6	266,000	100	
		Spray	36	10.4	104,000		39
	Aug. 27	Sugar	6	34.0	340,000	100	
		Spray	36	34.5	345,000		101
					Av.	100%	71%

Av. cu. ft. air sampled.....Sugar, 5; Spray, 34.

TABLE III.

COMPARATIVE COUNTS WITH THE WATER SPRAY SAMPLER AND THE GRAHAM-ROGERS PLATE.

Place.	Date.	Sampler.	Count per cubic foot by sizes.				Total.
			1.	2.	3.	4.	
Hat fur	Aug. 9	Spray	0	0	9,200	651,000	660,000
		Plate	0	0	1,650	4,580	6,230
		Ratio	0	0	18.0%	0.7%	1.0%
		Spray	0	0	0	676,000	676,000
		Plate	0	482	0	4,100	4,580
		Ratio	0	+	0	0.6%	0.7%
Burlap bag	Aug. 12	Spray	0	0	13,600	226,000	240,000
		Plate	60	60	301	2,530	3,050
		Ratio	+	+	2.2%	1.1%	1.2%
	Aug. 13	Spray	0	0	16,000	1,510,000	1,530,000
		Plate	0	0	724	16,600	17,300
		Ratio	0	0	4.5%	1.1%	1.1%

it will be seen that the counts from the latter represent just 1 per cent. of those from the former. The line marked "Ratio" is a percentage expression of the Plate Count divided by the Spray Count.

On the microscopic count basis, therefore, the proportionate rating of the three types of samplers with the sugar filter at 100 is 71 per cent. for the water spray and 0.7 per cent. for the Graham-Rogers plate.

Selective Action of the Plate Method.

From Table III it is seen that while dust particles of all sizes escape the plate there is some selective action, more smaller particles being lost then large. This finding bears out in a way what the originator of the method first claimed—namely, that the plate count emphasizes rather the larger particles in direct contrast to the Koniscope which gives undue weight to the minute particles.

But even though the proportion of the smaller size particles is relatively less in the plate method yet in actual numbers this smallest group, Class 4, makes up over 70 per cent. of the total plate count. Hence the least efficiency occurs in the group with the highest count and consequently any conclusions formed from comparative counts made with this method must be very carefully framed.

It is believed that fluctuations in rate of air flow past the plate, in temperature and humidity would have much greater influence in deter-

mining the count in this than in the other two methods.

On one occasion, August 9 (see Table I), the natural gravitation of particles to a plate exposed for the same length of time that it took to collect a 3 cubic foot sample with the air pump gave a count 65 per cent. of that with the pump sample.

The distribution of particles by sizes for each of the three methods is pictured in Table IV, which is a summary of the percentages presented in Table I.

TABLE IV.

PERCENTAGE DISTRIBUTION OF PARTICLES BY SIZES.

Method.	Sizes.			
	1.	2.	3.	4.
Sugar	0	0.2	2.8	97
Spray	0	0.2	2.8	97
Plate	1	4	10	85

From this it is seen that whereas the plate method introduces the selective action spoken of there is no difference in this respect between the other two methods.

Effect of Size of Sample on Accuracy of Count.

If then we should conclude our case on the basis of the foregoing figures it would appear that the Graham-Rogers plate lets 99 per cent. of the dust slip by and that the water spray filter is not anywhere nearly as reliable as the sugar filter. A further analysis, however, is illuminating.

Attention has already been called to the relatively much larger air sample collected with the water spray apparatus. That the size of the sample had a disproportionate influence on the count was felt by the authors in the early part of this work and this belief was later verified.

Samples of varying amount were accordingly taken in the same environment using each sampling method in turn. The influence of the volume of the sample on the resulting count is shown strikingly in Table V. The smaller the sample the greater is the resulting count per cubic foot.

To account for this peculiar result let us review the methods of sampling and the calculations involved in each of these methods to convert the microscopic count into particles per cubic foot.

In the sugar filter method, the sugar and its contained dust is emptied into a test tube, the adapter rinsed with distilled water into the test tube and the water made up to 10 to 15 cc. to act as a solvent for the sugar. From this test tube, which is well shaken, one cubic centimeter is transferred with a pipette to a Sedgwick-Rafter cell. This cell, whose dimensions are 50 mm. by 20 mm. by 1 mm. deep, is then placed under the microscope and moved about so that 10 representative areas each $\frac{1}{4}$ field or 0.25 sq. mm. in size are counted. The area is measured off by the micrometer in the eyepiece and the average count of 10 such areas is the figure appearing in the columns of Table I. No allowance was made for the dust in the sugar as several examinations at the

TABLE V.

Cubic feet of air sampled.	Counts per ¼ field.	Total particles per cubic foot.
(Samples taken with Sugar Filter in a Burlap Bag Factory on August 16.)		
.25	29.2	7,010,000
1.25	151.0	7,220,000
3.75	229.0	3,670,600
7.5	330.0	1,840,000
15.0	336.0	1,340,000
(Samples taken with Graham-Rogers Plate in the same place on August 17.)		
.33	5.7	124,000
1.7	10.1	43,900
5.0	9.6	13,900
10.0	33.3	24,100
20.0	37.4	13,500
(Samples taken with the Spray Filter in the same industry on August 17.)		
3.0	6.5	780,000
15.0	11.4	274,000
45.0	16.8	134,000
90.0	39.0	156,000
180.0	59.0	118,000
(Samples taken with the Spray Filter in a downtown office on October 27.)		
2.5	23.5	4,400,000
17.5	24.8	662,000
45.0	25.5	265,000
90.0	28.7	122,000
180.0	78.1	181,000
240.0	76.6	134,000

beginning of this work had shown this to average less than 1 per ¼ field.

In the case of the water spray apparatus 40 cc. of water are placed in the bulb and the loss by evaporation is made up from time to time in order to keep the air flow constant. After sampling, this water with suspended dust is drained into a bottle and the bulb is rinsed several times with distilled water. The final volume of water is then made up to 90 or 100 cc. One cc. of this sample is then transferred to the Sedgwick-Rafter cell and counted in the usual manner.

The Graham-Rogers plate is smeared with a thin film of glycerine to retain the dust particles hurled against it. This plate is counted directly under the microscope.

To convert these counts in the area marked off by the micrometer eyepiece into particles per cubic foot of air, it is necessary to know the volume of the liquid sample and the quantity of air sampled. There is, of course, no allowance to be made for water volume with the plate sampler.

Thus to take the figures in Class 4 in the first sample for the sugar filter on August 9 (see Table I) the conversion formula appears as follows:

$$\frac{43.1 \times 4 \times 1{,}000 \times 15}{3} = 43.1 \times 20{,}000 =$$

862,000 particles per cu. ft.

where 43.1 is the count per $\frac{1}{4}$ field (0.25 sq. mm.), 4 the conversion factor to sq. mm. as seen through the microscope (the cell being 1 mm. deep), or to cubic millimeters of sample examined, 1,000 the conversion factor to cubic centimeters, 15 the cubic centimeters of the dilution water and 3 the cubic feet of the air sample.

The corresponding calculation in the spray count for that day is:

$$\frac{18.7 \times 4 \times 1{,}000 \times 90}{15} = 18.7 \times 24{,}000 =$$

454,000 particles per cu. ft.

The corresponding plate count is computed as follows:

$$\frac{1.9 \times 4 \times 1{,}810}{3} = 1.9 \times 2{,}413 = 4{,}580$$

particles per cu. ft., where 1,810 is the number of times the area counted goes into the entire area of the plate.

To illustrate further how the constant error due to any or all of the following causes—dust in the sugar or distilled water, dust on the glass cover slip, on the lens of the microscope, imperfections in the glass slide or cover slip, which look like dust particles—may affect the resulting count, let us refer to the calculations for the sugar filter. If there were no constant error, or no dust particles included in the count except those actually a part of the sample, then the count of 862,000 is correct. If, on the other hand, there was a constant error of 10 particles per $\frac{1}{4}$ field the actual count would be 43.1 minus 10 or 33.1. The corresponding total count per cubic foot would in this instance amount to 662,000 particles.

The accuracy of the resulting count then rests largely in the correct estimation of the constant error and it is not possible to make this estimate with any degree of assurance. In the early part of our work we found as was stated that control counts on dissolved sugar were less than one per $\frac{1}{4}$ field. Subsequent control counts throughout the progress of this study have been as high as 30 per $\frac{1}{4}$ field and have averaged between 10 and 15. Being unable then to correctly estimate the error it is only possible to increase the accuracy of the count by minimizing the effect of this error. This can be done by sampling larger volumes of air so that the number of particles appearing in a $\frac{1}{4}$ field is correspondingly greater.

Thus if the quarter field count in one instance is 15 the resulting count is $\frac{15 \times 4 \times 1{,}000 \times 15}{3} = 300{,}000.$

The constant error we have found lies somewhere between 0 and 30. If it is zero then the above count is correct. If the error is 15 then the actual count would be zero.

Now if by increasing the volume of air sampled ten times the quarter field count is 150 and we subtract the maximum constant error of 30 we get 120 as the corrected figure. Uncorrected the resulting total count is

$$\frac{150 \times 4 \times 1{,}000 \times 15}{30} = 300{,}000.$$

With the corrected figure, 120, the corresponding total count is 240,000.

In the first instance there is a possibility for an error of 100 per cent. In

the second case the maximum error possible is but 20 per cent.

With the magnitude of the constant error in mind it is apparent that the efficiency of different sampling methods cannot be accurately judged unless the quarter field counts are nearer 100 than they are 10. Referring back to Table I, it will be noted that there are then only two opportunities for comparing the sugar filter and the spray sample on this basis—namely on August 13 and August 27. On both of these occasions the efficiency of the spray filter compares most favorably with the sugar filter, the average counts on the first date being 1,530,000 for the spray and 917,000 for the sugar, and on the second date, 345,000 for the spray and 340,000 for the sugar.

Summary of Results with the Three Sampling Methods Studied.

To summarize then the results of the foregoing experiments it is felt by the authors that:

1. The Graham-Rogers plate method is too inefficient as a dust sampling method to give results with different types of dust that are at all comparable.

2. The Water Spray apparatus is as efficient for practical purposes as the sugar filter.

3. The Water Spray apparatus is superior to the sugar filter in—

(a) Making possible the collection of larger air samples in the same period of time with the attendant greater accuracy in the count;

(b) Providing a sample whose dust content can be estimated by turbidity and weight as well as by counting;

(c) Being somewhat more portable (the spray sampler mounted in an ordinary suitcase weighing 17 pounds, whereas the sugar filter used in conjunction with the Wallace & Tiernan pump weighs 23 pounds);

(d) Simplifying and reducing the errors of technique in the substitution of distilled water as the filtering medium for solid soluble material such as sugar or resorcin whose dust content is a more variable factor.

Part II.

Extended Study of the Water Spray Apparatus as a Practical Sampler for Dust Analysis Work.

Armed with the data gathered from this preliminary study it was now proposed to determine the general usefulness of the water spray apparatus. The analysis of the sample was to include estimation by the microscopic count, weighing the solids after filtration through a Gooch crucible and reading the turbidity of the liquid against known standards.

Estimation of Dust by Turbidity of a Water Sample.

The analytical routine consisted first in transferring the sample, 90 cc. in volume, to a 125 cc. round glass-stoppered bottle. The turbidity was first measured by holding this bottle up to the light alongside of one of the standard bottles and identifying it with the nearest standard. This measure of turbidity is very crude but it was not thought worth while to spend time in refining this part of the work.

The turbidity standards were made up according to standard methods which specify a mixture of 1 gram of

TABLE VI.

RESULTS OF ANALYSES OF SAMPLES COLLECTED WITH WATER SPRAY APPARATUS.

Date.	Source of dust.	Cubic feet of air sampled.	Time of sampling, hours.	Weather.	Constant error per ¼ field.	Net count per ¼ field.	Total count per cu. ft.	Turbidity.		Weight of sample (milligrams).	Grams per million liters of air.	Comments.
								100 cc. sample.	Per 100 cu ft. air			
Group 1 (see Footnote).												
Oct. 13	Outdoors—Balcony City College	300	1	Fair, warm, some breeze	4.4	93.7	125,000	10	3	0	*−0.1	
		300	1		4.4	101.4	135,000	10	3	0	−0.1	
		270	1		4.4	137.9	199,000	10	3	1	0.13	
Nov. 8	Outdoors—Woolworth Bldg.											
	Street Level	420	2	Fair and windy	15.0	117.8	118,000	100	25	13	1.1	At street level air was somewhat dusty
	10th floor	420	2		15.0	71.7	72,000	30	7	4	0.3	
	58th floor	420	2		15.0	23.3	23,000	20	5	2	0.17	
Oct. 27	Business office	180	1	Fair, dry	4.0	78.1	172,000	50	30	1	0.2	
		240	1		4.0	76.6	128,000	40	15	3	0.4	
Oct. 21	Department store basement	180	1	Fair	0	53.4	118,000	40	20	5	0.9	Sampling from 10.30 a.m. to 4.30 p.m. Dusting of stock 8.30–9.00 a.m. 77° D.B. 70% R.H.
		180	1		0	52.3	115,000	40	20	3	0.6	
		180	1		0	42.8	94,000	40	20	2	0.4	
		180	1		0	47.7	105,000	40	20	1	0.2	
Group 2.												
Nov. 9	Pearl Button Factory	180	1	Cloudy, some breeze	8.0	47.0	103,000	20	11	0	−0.2	75° D.B. 50% R.H.
		180	1		8.0	56.3	124,000	10	5	0	−0.2	Drills going intermittently
		210	1		8.0	37.6	72,000	20	10	0	−0.2	
		180	1		8.0	63.0	139,000	10	5	1	0.2	
		210	1		8.0	49.0	93,000	20	10	..	...	
Nov. 30	School lunchroom (D)	210	1	Fair and some breeze, 60° F. temp.	8.0	136.0	258,000	150	70	6	1.0	500–1500 pupils present
		210	1		8.0	103.0	196,000	100	50	11	1.9	
		210	1		8.0	51.3	97,000	50	25	2	0.3	Very few present. 58° D.B. 36% R.H. Windows open most of time more than usual
Dec. 1	School lunchroom (E)	210	1	Fair	8.0	136.5	259,000	100	50	4	0.7	30–150 present
		210	1		8.0	401.2	762,000	200	100	10	1.7	30–150 present
		210	1		8.0	574.3	1,090,000	300	150	12	2.0	Pupils out. Janitor sweeping. 67° D.B. 35% R.H.
Nov. 10	Marble cutting shop	210	1	Fair and windy	15.0	363.9	691,000	300	140	11	1.9	Compressed air chisels used
		210	1		15.0	360.8	686,000	300	140	13	2.2	
		210	1		15.0	310.3	590,000	200	95	13	2.2	
		210	1		15.0	330.0	627,000	300	140	14	2.4	

Nov. 9	Subway platform	210	1	Fair	0	1,220.1	2,320,000	600	285	12	2.0	
		210	1		0	767.6	1,460,000	400	190	11	1.9	
		210	1		0	671.5	1,280,000	300	140	10	1.7	
		210	1		0	592.0	1,130,000	300	140	11	1.9	
		210	1		0	623.8	1,190,000	500	240	18	3.0	
Oct. 19	Iron grinding room	175	50 min.	Warm and humid	9.0	148.5	3,420,000	30	20	1	0.2	Apparatus in current of air from doorway
		210	1		9.0	993.8	48,700,000	400	190	28	4.7	
		270	1		9.0	985.5	14,800,000	800	300	34	4.4	Apparatus in center of room in last three observations
		270	1		9.0	1,098.7	16,500,000	1,000	370	57	7.5	
Group 3.												
Oct. 28	Hat fur factory	240	1	Fair and dry and some breeze	5.3	360.5	616,000	300	120	27	4.0	
		240	1		5.3	254.7	435,000	200	85	13	1.9	
		240	1		5.3	391.5	666,000	200	85	32	4.7	
		240	1		5.3	412.6	701,000	200	85	20	2.9	
		240	1		5.3	338.3	575,000	300	120	31	4.5	
Nov. 16	Rag sorting shop	210	1	Fair	11.0	113.0	215,000	300	140	20	3.3	56° D.B. 30% R.H.
		210	1		11.0	152.7	290,000	300	140	24	4.0	
		210	1		11.0	171.7	326,000	500	240	28	4.7	
		210	1		11.0	298.9	568,000	900	430	47	7.9	
		210	1		11.0	150.6	286,000	500	240	23	3.9	
Oct. 20	Mattress renovating shop	15	5 min.	Cloudy	3.0	157.3	4,190,000	50	350	2	4.7	70° D.B., damp
		60	15 min.		3.0	231.0	1,530,000	300	500	4	2.4	
		120	30 min.		3.0	649.0	2,140,000	400	350	17	5.0	
		210	1 hour		...	.....	.....	1,500	715	59	9.9	
		240	1 hour		3.0	4,320.0	7,140,000	5,000	2,100	151	22.2	
Nov. 3	Feather drying with starch	210	1	Cloudy and windy, cold	0	412.5	784,000	9,000	4,300	721	116.0	Very hot dry room, 105° D.B. 20% R.H. Dust artificially created in 1st 2 samples. Natural process going on during last 3 samples. Feathers pack'd in starch are beaten by machinery to remove starch
		210	1		0	455.0	867,000	10,000	4,750	958	147.0	
		210	1		0	152.9	289,000	4,000	1,900	371	62.4	
		210	1		0	84.2	160,000	2,000	955	166	27.9	
		210	1		0	167.5	318,000	4,000	1,900	514	86.4	

NOTE: Sampling places are grouped by the degree of dustiness as judged by observer when collecting sample. Group 1—Not Dusty. Group 2—Dusty. Group 3—Very Dusty.

* Minus sign means "less than."

infusorial earth with 1 liter of distilled water. The turbidity of 1 part of this mixture added to 9 parts of water represents a turbidity of 100 and so on down the scale. Our standards included the following turbidities: 10, 30, 50, 100, 200, 300, 400, 500, 1,000.

Reading the turbidity of a sample against a standard can be done with a fair degree of accuracy if the substances causing the turbidity are alike but we found much trouble in comparing the turbidity of different substances. The readings were made most readily by placing the two bottles against the light or against a light background. This method was preferred to the recommended procedure known as the Jackson method in water and sewage analysis work.

The difficulty encountered in attempting to evaluate the turbidity of a liquid with light-colored solids against one with dark-colored particles was very great. We believe that to increase the accuracy of this work special standards should be prepared for each type of dust analyzed, the standards themselves being made up from the dust which is being measured.

In the manner in which our readings were made we feel that a sample read as 30 was nearer 50 than 10, that a sample read as 200 was nearer 200 than either 100 or 300 but we should not attempt to give them any closer evaluation.

Microscopic Count.

Following the reading of turbidity 1 cc. and sometimes several cc. of the sample were removed for the microscope count as previously described. A control count on the water and slide was made at each analysis and allowance has been made for this in Table VI.

Estimation by Weighing.

The balance of the sample was then filtered through a Gooch crucible whose net dry weight was known. The filter and sediment were then dried for 1 hour in an oven at approximately 99° C. A number of determinations proved that this treatment was sufficient without additional drying to give weights constant to 1 milligram.

Types of Dust Sampled.

During the months of September, October and November, 56 samples were collected from the following places—open air, iron grinding room, mattress renovating factory, department store basement, business office, a hat fur factory, a feather drying room where starch is used, a pearl button cutting room, a subway station, a marble polishing room, a rag sorting shop, and a school lunch room. The volume of air sampled varied from 15 to 420 cubic feet. A summary of the results of these analyses is presented in Table VI.

Discussion of Analytical Results.

It will be noted in this table that the sampling places have been grouped roughly in order of dustiness as judged by the observer and that there is in general a higher count, a greater turbidity and a heavier weight in the dustier places. This will be better shown in Table VII, where these figures have been averaged.

TABLE VII.

Group (observers' classification).	Count per cu. ft.	Turbidity per 100 cu. ft.	Weight (grams per million liters).
Not dusty	120,000	14	0.4
Dusty	3,900,000	120	2.0
Very dusty	1,200,000	1000	27.0

The most significant feature about Table VI is that the relationship between count, turbidity and weight is not constant for all dusts but varies with the type of dust. Taking, for instance, the entire lot of samples, it cannot be said that a very dusty place always has an excessive number of dust particles, a high turbidity or a great mass of dust as judged by weight.

Thus the rag sorting room is a very dusty place where the weights vary from 3.3 to 7.9 grams per million liters, yet the counts run from only 200,000 to 600,000. On the other hand the iron grinding room seems less dusty to the eye and nose yet its weights are about the same and the counts run from 3 to 50 million particles. These differences are of course explained by the size of the particles, their density and their color. The light-colored dusts seem dustier in a dark-tinted room than the dark-colored dust. This will evidently explain why the subway and iron grinding samples were not placed in the "very dusty" class although the analysis shows the dust content to have warranted this rating. Again the dust particles in these two places are very finely divided and there are more particles per gram than is the case with the rag dust.

What appears to be the most irregular finding is the small amount of dust collected from the pearl button factory which was described as dusty. This is undoubtedly due to the fact that the room in the neighborhood of the grinding wheels seemed dusty but that due to the constant wetting of the wheel and the removal of dust by means of a local exhaust system it is probable that very little dust was disseminated into other parts of the room. As the dust sampler was not located immediately in the range of the grinding wheel, it did not catch that dust-laden air which was apparent to the eye. Furthermore, because of their greater size there would be fewer particles for the same weight than with the iron dust.

The extraordinary weight of the starch samples and their comparatively small counts are also largely explained by the inability to obtain well mixed samples with the pipette because of the heavy turbidity of the liquid. Furthermore the starch particles are very large and their number per gram mass is slight compared with the heavier dusts.

The comments of the analyst on the general appearance of the dust particles under the microscope are given here as bearing on the above explanations.

Description of Microscopic Appearance of Dust from Various Sources.

Out of Doors, Uptown—Mostly minute and round.

Out of Doors, Downtown—Large, very opaque and irregular. Tendency to cluster.

Business Offic Very small. Occasional fibres.

Dept. Store Basement—Irregular. Mostly fibres and lint.

Pearl Button Factory—Small, mostly round and uniform.

School Lunch Room (D)—Particles of every description, mostly small.

School Lunch Room (E)—Particles of every description, fibrous, angular, round, dots, transparent, opaque, etc.

Marble Polishing Room—Large, very irregular and arranged in clusters.

Subway Station—Mostly small, brown, irregular and jagged.

Iron Grinding Room—Irregular and jagged. Look like iron filings.

Hat Fur Factory—Small, irregular. Few hairs.

Rag Sorting Shop—Mostly fibres, some very long. Irregular lumps and groups.

Mattress Renovating Factory—All sizes, including fibres, hair and lint. Many infusoria.

Starch Drying Room—Large oval or round and very regular.

TABLE VIII.

CLASSIFICATION OF DUST PARTICLES FROM DIFFERENT ENVIRONMENTS BY SIZES. PER CENT. OF TOTAL COUNT.

Source.	Classes.					Comment.
	1.	2.	3.	4.	5.	
Approximate Area—sq. mm.	.04	.01	.0004	.0001	Too fine to count	
Outdoors, uptown	0	0	0.4	99.6	+	Very small
Outdoors, downtown	0	0.02	2.58	97.4	+	Large
Business office	0	0	0.85	99.15	±	Very small
Dept. store basement	0	0	2.	98.	−	Lint. Irregular
Pearl button factory	0	0	3.6	96.4	−	Regular, Small
School lunch room (D)	0	0	2.5	97.5	+	Small
School lunch room (E)	0	0.05	1.6	98.35	+	All sizes and shapes
Marble polishing room	0	0	0.5	99.50	+	Large
Subway station	0	0.02	0.5	99.48	−	Small
Iron grinding room	0	0.04	0.71	99.25	+	Small
Hat fur factory	0	0.08	1.68	98.14	+	Small
Rag sorting shop	0.02	0.27	3.83	95.88	+	Long fibres
Mattress renovating room	0.01	0.10	1.06	98.83	+	All sizes
Starch room	0	0	26.	74.	−	Regular. Large

The division of the particles into the five classes of sizes fails to show as much variation as is suggested in the previous table of comments. This is because the variation in size occurs largely within Class 4. The proportion of the other sizes is about the same in all cases. The size table is presented for reference.

Agreement in the Variations of Count, Turbidity and Weight.

Attention has been directed in the preceding pages first to the apparent irregularity in the relationship of count, turbidity and weight, and the explanation for this, and secondly to the agreement of these different measures of dustiness for any one type of dust. This agreement is best shown with the rag, starch and mattress dust. To test this further there has been worked out for the entire lot of samples and for each type of dust separately, the relation between the variations in count and weight and in turbidity and weight. This computation is done, first by dividing the count for a particular sample by the weight, secondly by averaging the resulting ratios for all the samples in the group, thirdly by noting the departure of the individual ratios from the average ratio, fourthly, by adding the departures regardless of sign and getting the average, and fifth by dividing the average of the unit departures by the group average.

If differences in count are accompanied by proportionate differences in weight, then the ratios in Col. 1 will be identical and Cols. 3, 4, and 5 will contain only zeros. The greater the variation in Col. 1 the larger the number in Col. 5, which thus becomes an "index of consistency" between count and weight.

Taking the list of analyses in its entirety there is a negligible relationship or consistency between count and weight, the index being 108, and a somewhat greater consistency between turbidity and weight, this index being 46.

Considering, however, each type of dust by itself we get the following figures (Table IX):

EXAMPLE OF METHOD USED IN DETERMINING "INDEX OF CONSISTENCY."

Count.	Weight.	Count-Wt. (No. of hundred thousands divided by grams).	1. Ratio.	2. Average Column 1.	3. Departure of units from average.	4. Aver. departure of units from Group Average.	5. Ratio of Col. 4 to Col. 2 (%).
625,000	1.1	6.3/1.1	5.7		0.47		
535,000	0.8	5.4/0.8	6.8		0.63		
599,000	1.0	6.0/1.0	6.0	6.17	0.17	0.42	7

TABLE IX.

CONSISTENCY BETWEEN DIFFERENT MEASURES OF DUSTINESS FOR EACH PARTICULAR TYPE OF DUST.

	No. cases.	Index of consistency.	
		Count and weight (%).	Turbidity and weight (%).
Out of doors, uptown	3	19	0
Out of doors, downtown	3	32	28
Business office	2	44	60
Dept. store basement	4	48	47
Pearl button factory	5	20	35
School lunch room (D)	3	37	37
School lunch room (E)	3	14	9
Marble polishing room	4	12	15
Subway station	5	28	21
Iron grinding room	4	54	27
Hat fur factory	5	24	21
Rag sorting shop	5	25	17
Mattress renovating room	4	35	44
Starch room	5	14	13
Average		29.3%	25.0%

It is recognized at the outset that the accuracy of the consistency indices for the separate groups is quite unreliable from a purely mathematical standpoint owing to the few members in each group. In those cases also where the count-weight ratio and the turbidity-weight ratio are farthest from agreement, namely, out of doors uptown, business office, pearl button factory and iron grinding room, it will be seen that the weights are so small as to invalidate the calculations or, in the case of the last named, the counts are so exceptionally high as to cause grave inaccuracies in estimation. It is felt, nevertheless, that the agreement of the two sets of computations is significant in that it indicates certain peculiarities about different types of dust which render any interpretation of dustiness on the basis of count alone to be incomplete. And it is further suggested that the determination of dustiness by turbidity is as exact as counting.

An examination into the relative merits of the count and weight as independent measures of dustiness are pictured in Tables X and XI, which are computed from Table VI. In the following two tables we have recorded the number of cases falling within a particular weight group or count group and have also classified the results on the basis of air conditions in the room as reported by the observer.

TABLE X.

NUMERICAL DISTRIBUTION OF WEIGHT MEASUREMENTS FOR THREE GRADES OF OBSERVED DUSTINESS. (NUMBER OF CASES WITHIN EACH GROUP.)

	Weight (grams per million liters).				
	0.5 and below.	0.6–1.0.	1.1–5.0.	5.1–10.	10.1+.
Not dusty	9	2	1	0	0
Dusty	6	2	14	1	0
Very dusty	0	0	12	2	6

TABLE XI.

NUMERICAL DISTRIBUTION OF COUNT MEASUREMENTS FOR THREE GRADES OF OBSERVED DUSTINESS. (NUMBER OF CASES WITHIN EACH GROUP.)

	Count (particles per cubic foot).					
	100,000 and below.	110,000 to 500,000.	510,000 to 1,000,000.	1,100,000 to 5,000,000.	5,100,000 to 10,000,000.	10,000,000 +.
Not dusty	3	9	0	0	0	0
Dusty	3	6	6	6	0	3
Very dusty	0	8	7	3	1	0

Rough as these measures are it is evident that the dustier the appearance of the air the greater is the dust content of the sample as determined by weight. On the other hand this is not so true with the count, for it is frequently found that the number of particles is greater in places which seem moderately dusty than in those reported as very dusty.

Efficiency of Water Spray Sampler.

In the first part of this article there was described an effort to compare the relative efficiency of the three types of samplers. It at first appeared that the water spray apparatus collected but 70 per cent. of the particles caught in the sugar filter. This conclusion was based entirely upon counts, whose reliability have since been discredited; and upon analyses of small air samples, which practice we now know to be inaccurate. That the efficiency of the spray apparatus is actually very high was indicated by a new test.

First carmine powder was gently blown over the inlet of the sampler while in operation, a small glass slide coated on the under side with glycerine having first been suspended in the outlet end of the glass bulb. The

water reddened immediately but it was only after several minutes that a visible red deposit was noticed on the wire supporting the glass slide. Examination of this slide under the microscope showed the presence of many carmine particles.

This test was then duplicated quantitatively using in this instance dessicated pearl dust. A small amount was placed in a test tube and the mouth tightly covered with bolting cloth. The tube and contents were weighed, then while the sampler was running this tube was gently tapped over the inlet so as to remove, a little at a time, an appreciable quantity of dust. The tube was again weighed, the difference being the amount of dust dislodged. The dust content of the sampler was then determined by filtering the water through a Gooch crucible. The results of tests made in this manner on two different occasions gave the following figures:

	Test 1. Milligrams.	Test 2. Milligrams.
Pearl dust added to sampler	521	102
Pearl dust recovered in water	513	100
Lost	8	2
Per cent. dust collected by sampler	98.5%	98.0%

A possible criticism of this procedure would be that the air of the room was being filtered in the sampler along with the pearl dust and that this aerial dust may have made up for any pearl dust which might have escaped the water thus covering the error and making the efficiency appear too great. The sampler was run for but five minutes, however, which represents 17.5 cubic feet of air, and as reference to Table I will bear out, dust collected from even 200 feet of air in a comparable environment—for instance the business office or the department store basement—failed to give more than 5 milligrams, it is highly improbable that 17.5 cubic feet of air would contain even 1 milligram of dust. Thus while it is evident that some very light dust passes through the sampler, the amount as judged by the quantitive determination is very small indeed.

This direct evidence as to the sampler's efficiency is further supported in a general way by comparing the weight results in Table VI with the amounts of dust found in similar environments by other observers (See Table XII).

In the ten types of dust shown in this table a comparison of the results of two or more observers is possible in six cases. Our results fit in very well with these analyses excepting those obtained by Graham-Rogers, whose high figures are accounted for in all probability by the very small volume of air sampled, namely 4 to 18 cubic feet. It is also possible in the case of the factory dusts that conditions were much worse at the time those samples were taken than they are now.

TABLE XII.

Type of dust.	Sampler.	Observer.	Weight of dust (grams per million liters).	Volume of sample, cu. ft.	Time of sampling, minutes.	Rate cu. ft. per minute.
Country	Water bubbling	Graham-Rogers (15)	7.0	18	....	....
	Paper thimble	Mariner & Hoskins (12)	.06	1000	360	2.8
	Water spray	Palmer et. al. (14)	0.1	300	60	5.0
City street ..	Water bubbling	Graham-Rogers	30.0—114.0	18	....	....
	Paper thimble	Mariner & Hoskins	2.5	1000	360	2.8
	Sugar filter	Soper	1.8	50	....	....
	.....	Fodor	0.4	....	....	....
	Water spray	P.	1.1	420	120	3.5
Subway.....	Sugar filter	S.	2.0—7.0	50	....	....
	Water spray	P.	1.7—3.0	210	60	3.5
Hat fur.....	Water bubbling	G-R.	17.0—80.0	18	....	....
	Water spray	P.	2.0—5.0	240	60	4.0
Pearl button	Water bubbling	G-R.	5.0—342.0	18	....	....
	Water spray	P.	0.2	190	60	3.1
Rag.....	Water bubbling	G-R.	20.0	18	....	....
	Water spray	P.	3.0—8.0	210	60	3.5
Pottery.....	Cotton wool	Ditman (11)	6.0—60.0	8	15	0.5
Mine rock...	Sugar filter	Lanza (8)	6.0—80.0 (Total solids)	1	2	0.6
Lead	Cotton wool	Duckering (10)	1.0—563.0	10	180	0.06
Garbage flue	Wire mesh and Water bubbling	Klein (9)	143.0—3210.0	20	20	1.0

It is probable that the most reliable of all these figures are those reported by Mariner & Hoskins for here a fine paper thimble filter, very effective as a dust collector, was used and samples were collected over a six-hour period, approximately 1,000 cubic feet of air being passed. In the thinly settled or park districts of Chicago they found .06 grams per million liters. We found in our samples taken at a balcony window on the third floor of the City College building about 0.1 grams per million liters. In the downtown loop district of Chicago their analyses averaged 2.5 grams per million liters. Our single two-hour sample at the street level near the Woolworth Build-

ing amounted to 1.1 grams per million liters. The figures of 1.8 obtained in the New York streets by Soper and 0.4 reported by Fodor from a level 15 feet above the street in Budapest are in general agreement with the above.

From this table it is possible to obtain a rough idea of the amount of dust to be expected in various types of environments. Expressed in grams per million liters the figure for country air is less than 0.1, for city air at street level about 1.0, for industrial processes from 1.0 to 100. Surveying the volumes of air commonly sampled with these different methods together with the rate of sampling we believe the spray sampler occupies a very favorable position in being a portable device which is capable of sampling with high efficiency several hundred cubic feet of air per hour.

Conclusion.

In summarizing, while we have great faith in the merits of the water spray sampler as a practical field apparatus, we do not wish to maintain that it is applicable to all situations or that it supersedes all other methods. There will always be a place for apparatus designed to meet certain special situations. Thus the sugar filter as used by Lanza is well adapted for excessively dusty atmospheres or where electric current is not available. Likewise the Whipples' study of dust distribution in Cambridge gave the information sought in a much simpler way and possibly in a manner that could not have been met at all by the water spray sampler.

In this connection, also, we feel that there is a field for the Graham-Rogers plate, used not in conjunction with an air-pump but simply as a gravity collecting plate. There are cases where either electric current is not available or the noise of the pump would not permit collection in this manner, and in such instances timed gravity collection would give counts comparative at least for similar types of dust.

For other work such as factory inspections, where samples representative of the air condition for varying periods of the day are desired, it is our belief that the water spray sampler is superior to the other methods we have reviewed.

In the technique to be followed with the water spray sampler we desire to express certain rules and precautions.

1. The rate of air flow should not exceed 5 cubic feet per minute.

2. To obtain sufficient dust for weighing purposes in atmospheres that are not visibly dusty there are required from 200 to 400 cubic feet of air.

3. In environments that are visibly dusty sampling need not be extended beyond 200 cubic feet and in fact it is unnecessary to exceed 100 cubic feet providing the water by that time is noticeably turbid, that is, equalling a reading of 200 on the turbidity scale.

4. For general inspection work we do not feel that it is necessary to measure the turbidity so long as the weight and count determinations are made.

5. For weight determinations it is recommended that the reading be carried out to a tenth of a milligram.

6. In counting particles in the Sedgwick-Rafter cell, it is suggested that a quarter field be counted at five points in the cell, at the center and

near the four corners. (This precaution is intended to minimize the inclination to seek out crowded areas of the plate to count and pass over the sparsely dotted space.)

7. Two distinct cubic centimeters of the sample should be counted in the Sedgwick-Rafter cell. The average count for the sample is then to be determined from the ten counts, five being made on each slide.

8. The cell should stand five minutes after being filled before the count is made. This time is sufficient to allow the dust particles to come to position either at the bottom of the cell or to the surface of the water. Otherwise particles between the top and bottom will be missed as it is not feasible to alter the focus of the microscope so as to search the entire depth of the liquid.

References.

(*Original publication not consulted.)

(1) References to the work by Liefmann, Hahn and Rubner were made in an article by John B. C. Kershaw, entitled "Dust, Soot and Smoke," *Cassier's Magazine*, Vol. 39, pp. 250–257, 1911. The authors have not consulted the original papers from which these references were taken.

(2) *Transactions of Royal Society of Edinburgh, Vol. XXXV, p. 1. Also Proceedings of Royal Society of Edinburgh, Vol. XVI, p. 135. Article by John Aitken.

(3) *The Nature, Vol. 41, Number 1061, p. 394. Article by John Aitken.

(4) Progress Report of Committee on Standard Methods for the Examination of Air. American Journal of Public Health, Vol. 3, No. 1, 1912, p. 80.

(5) "Studies in Air Cleanliness," by George C. Whipple and Melville C. Whipple. Trans. of the American Society of Heating and Ventilating Engineers. Vol. XXI, 1915.

(6) "A New Method of Determining Dust in Air and Fresh Air Schoolrooms," by John B. Todd, M. D. *New York Medical Journal*, Feb. 28, 1914.

(7) "The Air of New York City Schools," by Charles Baskerville and C.-E. A. Winslow. Report of Committee on School Inquiry, Board of Estimate and Apportionment, New York City, July 1, 1913.

(8) "Pulmonary Disease among Miners in the Joplin District, Missouri, and its Relation to Rock Dust in the Mines," by A. J. Lanza and Edwin Higgins. Technical Paper 105, Dept. of the Interior, U. S. Bureau of Mines, 1915.

(9) "Elimination of Odors, Barren Island Disposal Plants," by Irwin S. Osborn. Laboratory Report by Otto H. Klein. Report to Committee in Street Cleaning, Board of Estimate and Apportionment, New York City, 1915.

(10) Report of the Departmental Committee appointed to inquire into the dangers attendant on the use of lead, etc. Vol. II, Appendices. London, 1910.

(11) "Quantity of Dust in Some Dusty Trades," by Norman E. Ditman, M. D. *The Journal of Industrial Safety*, March, 1912.

(12) Report to Chicago Association of Commerce Committee on Smoke Abatement and Electrification of Railway Terminals. Laboratory Report on Air Analysis, by Mariner & Hoskins, 1915.

(13) "Problems in Smoke, Fume and Dust Abatement," by G. F. Cottrell. From the Smithsonian Report for 1913, pp. 653–685.

(14) "A New Sampling Device for the Determination of Aerial Dust," by George T. Palmer. American Journal of Public Health, Vol. 6, No. 1, pp. 54–55.

(15) New York State Dept. of Labor. Annual Reports on Factory Inspection, 1910, pp. 44, 67–73.

(16) "Air and Ventilation of Subways," by George A. Soper. John Wiley & Sons, 1908.

(17) *"Luft, Boden und Wasser," by Joseph Foder. Braunschweig, 1881, Vol. 1. Quotations from above reviewed in Wolpert "Die Ventilation," Berlin, 1901, pp. 73–80.

Editorial Section

Selskar M. Gunn, Editor
Prescott W. MacNeill, Business Manager

Editorial Assistants
A. D. Hiller W. H. Coon, M. D. D. F. Ryan

Board of Advisory Editors
Dr. Peter H. Bryce, Ottawa, Canada. Dr. Livingston Farrand, Boulder, Col.
Dr. Charles V. Chapin, Providence, R. I. Prof. George C. Whipple, Cambridge, Mass.
Dr. William C. Woodward, Washington, D. C.

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the American Public Health Association, unless such statements or opinions have been adopted by vote of the Association

NOTICE TO SUBSCRIBERS

SUBSCRIPTION PRICE, $3.00 a year, in advance, to any point in the United States or its possessions. Foreign Countries, 50 cents extra for postage. Canada, 25 cents extra for postage. Single copies, 30 cents.
ADVERTISEMENTS accepted only from reliable firms. Fraudulent and misleading advertisements barred.
IN CHANGES OF ADDRESS both the old and new addresses must be given.
RENEWAL BILLS are sent one month in advance. Prompt attention to them prevents discontinuance from the mailing list. Magazines are not sent beyond the subscription period.
As the MAILING LIST for each month's issue closes on the first of that month, changes of address, renewals, subscriptions, etc., must reach us before that date to be effective with that issue.
COPYRIGHT, 1916, by Selskar M. Gunn.

CONCERNING OURSELVES.

This issue of the Journal should reach the majority of its readers prior to the annual meeting of the American Public Health Association, which takes place in Cincinnati October 24 to 27.

It is certain that the attendance will be large, despite the fact that the meeting comes at a time when it is difficult for those members of the Association who are teachers to be present.

It is over forty years since the Association met in Cincinnati. The attendance at that time was but seventeen. The great discoveries and advances in public health knowledge are reflected in the constant growth in the membership of the Association and the circulation of its Journal.

A special plea for assistance from members and subscribers is now being made. The growth of both Association and Journal are shown graphically in the advertising pages. That progress has been made is evident. Undoubtedly the progress would be much more rapid if funds were at our disposal to carry on an extensive campaign. Such funds are not available so Association and Journal must continue to advance as in the past through the kindly efforts of their friends.

Health education looms large in modern public health work. That it is desirable to educate the public in health matters is accepted. It is obvious that first we must educate the educator, namely the health officer, the sanitary inspector, and the large number of others who are directly or indirectly engaged in the inspiring work of public health. Education is never finished and in our chosen line of work new discoveries are constantly made and new methods devised and used, which we want to be informed about.

Your secretary and editor has perhaps wearied you with his appeals for assistance in helping to acquaint others with the work of both Association and Journal. He makes no apology believing that it would be a dereliction of duty did he not do everything in his power to advance the objects for which both the Association and Journal have faith in.

DEATH-RATES IN THE REGISTRATION AREA OF THE UNITED STATES IN 1915.

A preliminary statement just made public by the Bureau of the Census, Department of Commerce, shows a death-rate of 13.5—the lowest on record—per 1,000 estimated population of the registration area of the United States in 1915. This rate was based on 909,155 deaths returned from 25 states (in one of which, North Carolina, only municipalities of 1,000 population and over in 1910 were included), the District of Columbia, and 41 cities in nonregistration states, the total population of this area in 1915 being estimated at 67,337,000, or 67.1 per cent. of the total estimated population of the United States.

There is a widespread and increasing interest throughout the country in respect to vital statistics. The states of North and South Carolina, which recently enacted the "model law" for the registration of births and deaths, were admitted to the death-registration area for 1916, increasing the estimated population of the area to 70.2 per cent. of the total for the United States in that year.

The death-rate for 1915, 13.5 per 1,000 population, is the lowest ever recorded, the most favorable year prior to 1915 having been 1914, for which the rate was 13.6. It is markedly lower than the average rate for the five-year period 1901 to 1905, which was 16.2. The decrease thus amounts to 16.7 per cent., or almost exactly one-sixth, during a little more than a decade. When due allowance is made for the addition of many new states to the registration area between 1905 and 1915, and the comparison is confined to the group of registration states as constituted during the period 1901–5—the present population of which is about one fourth of the total for the country—there is still shown a very considerable decrease, from 15.9 to 14.3 per 1,000 population, or 10.1 per cent. This decrease, on the basis of the present population, would amount to 42,876 deaths. On the assumption that a corresponding reduction has taken place throughout the entire country, this would indicate a saving of approximately 170,000 lives in 1915 for the United States as a whole.

It is certain that the great progress made during recent years in the sciences of medicine and sanitation, together with the wide-spread awakening of the people throughout the United States to the support of public health authorities, has resulted in the saving annually of scores of thousands of lives that would have been lost under the conditions prevailing only a few years ago.

It is pointed out in the statement issued to the press that "the rates given are crude rates, which make no allowance for differences in the sex and age distribution of the population, and that, furthermore, the rates for certain localities are materially affected by deaths of non-residents who are attracted to those localities by their favorable climate or by their superior hospital facilities. Inferences in regard to the relative healthfulness of different states and cities should not, therefore, be drawn without more thorough investigation."

It is to be hoped that the newspapers will give better heed to this sound advice than they have in the past and save us from the absurd comparisons that caused a prominent health officer to express the opinion that there should be a law prohibiting the sending of crude death-rates through the mail.

The 1915 figures were prepared under the supervision of Mr. R. C. Lappin.

THE CONTROL OF COMMUNICABLE DISEASES IN SCHOOLS.

S. Josephine Baker, M. D.,
Director, Bureau of Child Hygiene, Department of Health, New York City.

Read before a General Session of the American Public Health Association, Rochester, N. Y., Friday, September 10, 1915.

Dr. Josephine Baker, as director of one of the most important bureaus in the New York City Department of Health, has become one of the country's best known women health workers. Her experience in the matter of which this paper treats has naturally been very extensive.

THEORETICALLY, the control of communicable diseases consists in making a diagnosis sufficiently early so that the patient may be isolated and infection of others prevented. Practically, the elimination of infection involves the employment of educational and preventive, as well as corrective, sanitary and hygienic measures.

In a discussion of the more common types of infections, exclusive of tuberculosis, we are led inevitably to a consideration of their age grouping and it is a matter of record, as well as common knowledge, that the great majority occur during that period of life which is properly known as the "school age" or from five to fifteen years of age. We speak of the "contagious diseases of childhood" and inevitably associate their occurrence with the beginning of school attendance. The stigma placed upon schools as foci for the dissemination of infection has not been undeserved. With regard to the more common types, including scarlet fever, diphtheria, measles, german measles, whooping-cough, mumps and chickenpox, the curve of incidence begins with the opening of the schools in the fall, reaching its maximum in the late winter months, and falling again to the minimum as the schools close in the spring. It is probably of equal, or even greater importance, to note that the curve also follows closely the advent and increasing tendency of lowered outdoor temperature with the habit of living in overheated and closed houses or schoolrooms. Both of these factors may be considered as an indictment of school life as it still exists in too large a proportion of our communities.

In tuberculosis the causative factors relate equally to the school and to the home. If we do not definitely regard this disease as one mainly incident to child life, at least we are becoming increasingly aware that the infection is commonly acquired during childhood and that the degree of physical resistance of the individual which is to ultimately decide whether the infection shall remain latent or shall develop, depends to a very large extent upon the degree of physical health

which may be acquired during the formative years of childhood.

The school, with its segregation of large numbers of children during the winter months, offers a unique opportunity for early detection of cases of communicable disease. The routine control of infections by sanitary authorities takes as its starting point the actual reporting of a case of illness; much may then be done by enforcing procedures of isolation, but too often such notification occurs after the child has had abundant opportunity of spreading the infection both at school and at home. The ordinary tenement house in our cities may now be considered as the starting point of most local epidemics; the school, where proper health supervision is maintained, can no longer be accused of holding primarily this unenviable reputation.

School medical inspection was instituted in this country for this purpose, at first in Boston in 1894, when Commissioner Durgin started such a system to control an epidemic of diphtheria; a few years later New York City and Philadelphia recognized the value of such a procedure and at the present time, although school medical inspection has developed to include the vastly important control of all matters affecting the health of the child, the early detection and exclusion from school of children showing any symptoms of a communicable disease still remains as the part of the system which is primarily the function of health departments. Logically, the prevention of communicable diseases is so closely interrelated with the control of the general physical well-being of the child that in any well-planned and effective system of school medical inspection it is difficult, if not actually dangerous, to attempt any separation of function or authority.

As a working program I would submit the one followed by the Bureau of Child Hygiene of the Department of Health of New York City for the past six years.

The school building and its maintenance deserve first consideration. Classrooms should be large enough to provide at least three hundred cubic feet of air space for each pupil; each room should have direct sunlight at some period of the school day. Each child should have an individual desk with aisles at least two feet wide between the rows. Dry sweeping and dusting must be prohibited and proper oil dressing provided for the floors. Pencils should be individual and collected at the end of each day, in separate stout manila envelopes, marked with the name of the child, so that distribution may be made each morning. Lastly, and most important, adequate and free ventilation, with the provision of air at the right temperature and degree of humidity, is imperative.

In the school building, cloakrooms with individual ventilated lockers, or hooks placed at wide enough intervals so that the children's outer garments shall not be in contact, are essential. The further installation of drinking fountains or the use of the individual drinking cup, the elimination of the common towel and the provision of adequate and cleanly toilet and wash-

ing facilities, will all provide the needed surety of the first line of defense against the spread of infection in the school.

Many of the above installations and methods have not yet been attained in the New York City schools. The Board of Education, so far, has not placed in operation any effective plan for adequate ventilation or cleaning of classrooms, proper washing facilities or well-arranged cloakrooms, but it is hoped that these important matters will receive attention within the near future.

The main control for the prevention of the spread of communicable diseases in schools is dependent upon the system of school medical inspection. It is evident that such a system, to be effective, must rely upon such an early detection of symptoms which may indicate the onset of a communicable disease that the child may be excluded from school attendance and properly isolated at home before he has had an opportunity of infecting others. In other words, the child must be excluded upon suspicion. If we wait until an accurate diagnosis can be made, the harm has already been done.

In New York City each day, each school receives a printed list of all cases of communicable diseases reported to the Department of Health on the previous day. At the opening of the school session, this list, with a special blank book, is sent to each classroom, where the teacher enters the name of each pupil in the class who is noted on the list or who is a member of the family of the patient. Such children are excluded from school at once, to await the further action of the division of contagious diseases of the department. The book is then returned to the school nurse, who reports each day to the school inspector where two or more cases of any one disease have occurred in any one classroom. Thereafter, the inspector visits that class each morning, examining each child for any evidence of illness and excluding suspicious cases. If the disease is diphtheria, cultures are taken from the throat of each child and all cases showing the presence of the diphtheria bacillus are excluded.

Each day each school, except a few in the outlying districts, is visited by the school doctor or the school nurse. The teachers are instructed to send to the doctor's room, as soon as the classes assemble, every child who shows any evidence of illness in any form. Upon reaching the school, the doctor or nurse examines, in a room set apart for this purpose, (a) all such children referred by the teachers as suspected cases of illness, (b) all children returning after having been ill, and (c) all children who have returned to school after any unexplained absence. At this time, any child who shows any symptoms which might indicate the development of a communicable disease, is excluded from school attendance. Cultures are taken in every case of sore throat and the child is excluded. Within twenty-four hours the child is visited at his home by an inspector, who makes the diagnosis, either isolating the case and transferring it to the supervision of the division of contagious diseases, which thereupon assumes control, or, if no communicable

disease has developed, allowing the child to return to school. About 80 per cent. of the excluded children are found to have true cases of communicable disease; the loss of one day's schooling for the remaining 20 per cent. is of small consequence when compared with the effectiveness of this early exclusion.

Trained nurses have been almost exclusively used for the past two years for the purpose of early detection of the symptoms of suspected communicable disease, and because nurses are trained to detect symptoms and are not required or expected to diagnose, the percentage of cases where the presence of a communicable disease is afterwards confirmed averages the same as when physicians were exclusively employed for this purpose.

The early detection of tuberculosis results from observation of children who have been losing weight, appear flushed or hectic, with or without an accompanying cough, or who are designated as suspicious cases by the school doctor as a result of his regular physical examination. Such cases are referred to the Bureau of Preventable Diseases, which sends a diagnostician to the child's home to make the detailed or repeated examinations necessary to confirm the tentative diagnosis.

A monthly routine inspection of all children in each school, the physical examinations with consequent follow-up visits to adjust insanitary and unhygienic home conditions and to secure proper treatment of physical defects, are added preventive measures. In addition, at the end of each school day, the principals send to the school doctors a list of all children who have been absent from school more than three days for any unassigned cause. These children are visited at home by the doctor and many cases of unreported, and therefore uncontrolled, cases of communicable diseases are discovered by this so-called "absentee visiting".

This brief outline enumerates the main features of our system. The results may be stated even more briefly. During the six years since this system went into effect, it has not been necessary to close any public school in New York City on account of an epidemic of communicable disease, and in only a few instances has it been considered wise to close a classroom. This latter action in each instance has been taken not because we have considered it the best procedure but because the principal or teacher has become unnecessarily apprehensive after the occurrence of a few cases of illness in children who normally attended the class in question but who, except in isolated instances, were not in school during the period of incubation.

In this connection, I wish to emphasize the wisdom of keeping children in school rather than closing schools in the presence of communicable diseases in a community. School contact instances of infection are rare if the system of school medical inspection is at all adequate, and the presence of the children in the classroom each day, where they can be systematically observed for symptoms of approaching illness, offers a far greater degree of safety to the child and protection to

other children than can be attained by allowing them to be in their homes or on the street in indiscriminate contact with other children.

By following the system outlined above during the six-year period since the organization of the Bureau of Child Hygiene, out of an average school population of 800,000 children in New York City, an average of five thousand, or less than 1 per cent. have been necessarily excluded from school each year because of the presence of a general constitutional contagious disease.

Such control may be exercised in any community, and the school, instead of being the focus for the dissemination of communicable diseases, may become, because of its very adaptability to control, one of the most valuable methods we have of limiting the spread of communicable diseases in any community.

LONDON STATISTICS.

London Statistics, a volume of 600 pages, recently issued by the county council, gives evidence of the effect of the war on the health and well-being of citizens of the Metropolis. The population of the county area in June, 1915, was estimated to be 4,551,204 persons. By reason of enlistments, the civil population was smaller last year than that of the middle of 1914, but it is significant that the death-rate has increased. In the first 18 months of the war 104,571 persons died, compared with 97,333 during the preceding 18 months, and every age and both sexes were affected by the increase. "One would have expected a reduction," says the report, "notwithstanding that the enlistments came from among the 'good' lives. . . . The figures suggest the possibility of an influx of population of military age into London since the war. If so, it must have been an influx of women." Whether the cause is traceable to a shortage of medical aid generally, to local conditions of over-pressure or overcrowding, or to a combination of these with other causes, no evidence is as yet available to show.

The first nine months and the second nine months of the war yielded 82,628 and 74,948 births respectively. In London, as generally throughout the country, statistics prove that there is no truth in the statements which have been made as to an increase in the number of illegitimate births.

The war has evidently been responsible for hastening many weddings. Whereas in the preceding five quarters there were 51,239 marriages registered, the number leapt up to 65,522 in the five quarters since the outbreak of hostilities.

Pauperism has steadily declined during the past year, both indoor and outdoor, and it is further encouraging to note that "with plentiful employment there has taken place an almost general rise in wages. The movement in London has been part of the movement throughout the country."

As a set-off against this, the increased cost of living has to be taken into account, but "in spite of the steep rise during 1915, the prices of bread and wheat are still below the average of the 110 years 1800–1910. They are also both less than half the price of the same commodities in 1812, but the Napoleonic wars by that time were in their eighteenth year."—*Medical officer*.

THE WEST VIRGINIA FLOOD OF AUGUST 9, 1916, AND THE HEALTH RELIEF MEASURES.

MAYO TOLMAN,
Director and Chief Engineer, Division of Sanitary Engineering, West Virginia State Department of Health.

ON THE morning of August 9, 1916, Cabin Creek, Coal River, Paint Creek and Mud River Districts of West Virginia, an area of some 400 square miles, were visited with a disastrous flood. Newspaper reports stated that the flood was caused by a cloud-burst, but investigation shows that the storm was an exceedingly heavy downpour of several hours' duration. It traveled in a southeasterly direction, the center passing through Griffithsville on Mud River, Horse Creek and Nelson on Coal River, and Kayford on Cabin Creek. The greatest damage was wrought at Kayford, where, from the best data available it appears that the storm lasted from 4.30 a. m. to 9 a. m. There are no rain gauges in the flood district, and all estimates of the rainfall are probably much in error. The most accurate record of which I could learn was that obtained by a retired mine fire boss at Kayford who stated that 5.82 inches fell during the storm. His measurement was made in an ice cream can.

The flood reached a much greater depth on Coal River than on Cabin Creek. At Seth, on the former stream, 54 feet 2 inches were read on a privately maintained gauge, while the greatest depth encountered on Cabin Creek was about thirty-two feet. The damage, however, was far greater on the latter stream, as it was closely built up with mining towns, whereas on Coal River there are but comparatively few mines opened, and the narrow river bottoms are given over to small farms.

It is estimated that seventy-one lives were lost in the flood and that over nine hundred houses were entirely wrecked, with a total property damage in excess of $2,000,000. The Chesapeake & Ohio Railroad had the greater portion of its road bed for eighteen miles obliterated. Not a single railroad bridge in the entire distance was left in position. At only two points was it possible to tell where the county road had been previous to the flood.

On the morning of the flood Dr. S. L. Jepson, the Health Commissioner of West Virginia, sent one of the assistant engineers up Cabin Creek to ascertain the extent of the disaster. The writer was in Pittsburgh at the time, but realizing the grave danger of serious outbreaks of typhoid due to contamination of wells which constituted the only source of drinking water for a population of over 10,000 in the flood area, he returned to Charleston immediately, after first having telegraphed to Baltimore for a large supply of anti-typhoid vaccine. All the chloride of lime in Charleston and Huntington, West Virginia, and Columbus, Ohio, was obtained by telegraph and an order placed for several hundred pounds in addition. A local chemical manufacturing company was instructed to hold several carloads of agricultural lime ready for immediate shipment; also instructions were telegraphed to the state printer to have

several hundred posters 18 by 24 inches struck off with the statement "This Well Probably Safe for Drinking."

As there were a number of cases of typhoid fever on Cabin Creek and Coal River previous to the flood, the chance that the wells, a great majority of which were flooded by the sudden rise of water, had become dangerously contaminated, was the chief problem that faced the Division of Sanitary Engineering.

To lessen this danger as far as possible the writer with his two assistant engineers, Mr. Ellis S. Tisdale and Mr. Andrew N. Wardle, both graduates of the Massachusetts Institute of Technology, entered the district prepared to disinfect all wells that had not been filled with mud and silt and to administer the anti-typhoid vaccine to all who would take it. As the roads were washed away and the valley strewn with wreckage, it was impossible to get even a pack animal through, and we were obliged to carry all our provisions, blankets, vaccine and chloride of lime, on our backs.

All wells that were in any way fit for use were disinfected with chloride of lime and posted as shown.

The writer deemed it wise to make a hurried trip through the entire valley, disinfecting at least one well in each community that safe water might be obtained at all points as quickly as possible, and then after this establish headquarters at some central point and from this place to direct the disinfection of the other wells as fast as they could be cleaned. The first day some thirty wells, scattered over a distance of ten miles, were each treated with from a quarter to half a pound of chloride of lime. As each well was treated it was posted with a sign, "This Well Probably Safe for Drinking."

The coöperation of the hospital corps of the West Virginia National Guard, which had been ordered into the flood district, and of the local mine doctors in the giving of the anti-typhoid vaccine, was solicited and obtained. A campaign of publicity to overcome the prejudice that the miners entertain toward all forms of vaccine was inaugurated at the suggestion of one of the doctors. Small boys were paid 25 cents apiece to carry

The ruined Y. M. C. A. at Eskdale. Headquarters of the Division of Sanitary Engineering.

posters up and down the valley stating that the anti-typhoid treatment would be given free at certain places at certain times. Other posters had skulls and cross-bones with "Beware of Typhoid. Be vaccinated before it is too late." At each town visited, some small boy who looked brave would be singled out and given the treatment. Then he was told to jolly his chums about being cowards, with the result that some fifteen or twenty small boys would take the treatment. These would be divided up in squads of four and sent marching through the town with their left sleeve rolled up, calling out "It doesn't hurt to get vaccinated." The results of this system of advertising surpassed our best expectations. One doctor vaccinated over 400 the first afternoon. We slowly waked up the interests of the people to such an extent that the usual salutation in passing the time of day when two friends met was, "Been vaccinated yet, Bill?" "Yep, took it half an hour ago. Don't see why I ever swore I'd never take it. Didn't bother me as much as a pin scratch."

Each doctor in the flood district was visited in person by one of the engineers and given the amount of typhoid vaccine that he felt he could probably use. Nearly every doctor told us that he wouldn't need many treatments, as the miners could not be made to take it; yet before two days were up nearly all had sent messengers to our headquarters in the ruined Y. M. C. A. building at Eskdale, asking for more. The final returns giving the name, address, etc., of each person vaccinated have not as yet been received from the doctors, but the writer has returns on his desk showing that at least 4,467 civilians were vaccinated. It is estimated that 90 per cent. of this number will take the full three doses, and that the total number of those receiving one dose will pass the 5,000 mark.

As yet no word had reached the

writer's office of any infected arms, which is remarkable when it is considered that some of the doctors would vaccinate as many as ten people without resterilizing the needle. Whenever possible we attempted to prevent such practice and supplied the doctors with grain alcohol that they might at least rinse the needles.

It should be noted that the engineers took charge of the disposal of the bodies of dead animals, as mules, dogs, hogs, etc., which were found in numbers in the piles of débris. As fast as the railroad was rebuilt into the district, lime was shipped in for use in sweetening the ground about the houses, many of which had two or three feet of mud on the floors. Lime was also freely used about the privies.

The results obtained from the wholesale anti-typhoid vaccination on Cabin Creek, Coal River and Mud River should prove of great interest to health officers throughout the entire country as, so far as the writer is aware, it is the largest number of civilians ever vaccinated at one time. Larger numbers have received the treatment in the army and in large labor camps, but in these places living conditions are highly specialized, the food, water, housing conditions and health being carefully looked after at all times, whereas in the work done in the flood district of West Virginia we now have an opportunity to study the effectiveness of the treatment under ordinary living conditions in all stations of life, from the mine superintendent to the most illiterate miner and his family.

The work of the Division of Sanitary Engineering should prove of great value. The West Virginia miner is nomadic in his habits, as he seldom lives more than a few months at one place. The flood has caused a general exodus of miners from the creek, 60 per cent. having left, and unless every precaution against an outbreak of typhoid had been taken, the disease would probably have been carried to all parts of West Virginia, and to Ohio and Kentucky as well.

Ruins of power plant of Chesapeake and Ohio R. R. at Eskdale.

In closing it should be noted that the work could not have been accomplished without the aid of the local doctors who everywhere gave valuable assistance.

Received for publication, September 11, 1916.

SIX MONTHS OF THE HARRISON ACT.

C. E. TERRY, M. D.,
City Health Officer, Jacksonville, Fla.

Read before a General Session of the American Public Health Association, Rochester, N. Y., September 9, 1915.

Public health officials, the medical profession generally, pharmacists, lawyers, legislators and the public have all watched with interest the working of the Harrison Act, by means of which the federal government has taken part in the effort to control the narcotic drug traffic. In Doctor Terry's city, special efforts have been made in this respect.

IN PRESENTING these impressions of the national anti-narcotic law, known as the Harrison Act, of its provisions as directed at the various sources of supply and distribution of the drugs with which it deals and of its apparent practical workings since March 1 of the present year (1915), no criticism is intended other than such as may in some measure, possibly, assist in determining the factors which have united to establish this nation-wide problem of narcotism and the lines of attack which promise the most efficient control.

It is undoubtedly too early to form any definite judgment as to the ultimate efficiency of this act of legislation. So replete is it with provisos and exemptions, so non-specific on certain essential points while conferring powers of such sweeping character on those to whom its enforcement is entrusted, that an early judgment might lead one to conclude, with almost equal likelihood of truth, that it will fall far short of accomplishing its apparent design or, on the other hand, that no possible leak has been overlooked in its broad scope.

Such evident confusion of opinion has already become manifest and an earnest effort on the part of the writer to reconcile the several sections of this Act as relating to the drug traffic, has failed, in one instance at least, to clarify the situation.

It is probably quite fair to assume, as a basis for what follows, that opium and coco leaves and their derivatives and preparations have acquired a widespread non-legitimate use in this country and that Congress enacted the Harrison law in order to limit the employment of these poisonous substances to legitimate and proper channels.

It would also appear evident that "legitimate," as applied to the employment of these drugs, means such use as would benefit those consuming them or at least such use as might be reasonably expected to result in benefit by those whose training and experience render them capable of judgment.

Bearing these premises in mind, one is forced to the inevitable conclusion that, in the present state of medical knowledge, the legitimate use of these drugs is distinctly limited to the treat-

ment of disease and the relief of suffering which simpler and more permanent measures may fail to accomplish.

Conversely, any legislation, which fails to confine to such purposes the employment of these drugs, falls short, in exact measure of such failure, of accomplishing its design. In order to avoid any charge of "local factors," expressions from a wide territory have been sought, through a questionnaire sent out under the direction of your Committee on Habit-forming Drugs. Officials in every state have been addressed, the data acquired representing about fifty cities from which replies were received.

The questions thus circulated dealt with general aspects of the drug problem, some of the principal sources of supply and certain exemptions of the federal law, seeking to relate each to the purpose of the Act.

In what follows it must be borne in mind that the Act has not as yet been enforced with equal vigor in all communities, that the territory assigned to each deputy is large and that the correspondents may not be accurately informed in all cases.

Fifty-five replies have been received. In reply to the question "Has the Harrison Act been enforced in your community?"—43 reply in the affirmative, 5 say "No," 4 "Not actively," while 3 are in doubt. There is thus indicated, for the most part, official activity, as would indeed be inferred from the press accounts throughout the country.

As to whether it had been customary for physicians to write prescriptions for drug addicts, prior to the enforcement of the Harrison Act, 37 replied "Yes," 6 "No," 4 were uncertain but thought it had been, while 8 claimed that they were uninformed or that druggists made direct sales and the formality of a physician's prescription was unnecessary. Asked whether the Harrison Act had stopped this practice, 10 replied "Yes," 4 "No," 24 "To a great extent," while 7 were in doubt or uninformed.

The well known rôles played by certain members of the medical profession in the tragedies of drug addictions in the past, attach especial interest to the replies made to these two questions. Owing to the relatively greater restrictions thrown around dealers in drugs, by the Harrison Act, the medical profession occupies a conspicuous and responsible position in the solution of the problem of drug addiction and it would appear futile to attempt to control the situation without either the *complete coöperation* of physicians or—*ample* restriction of their use of these drugs.

It would appear, from the information at hand, that, as yet, neither requisite has been obtained.

Questions 4, 5 and 6 related to provisions for the treatment of indigent addicts and the number treated. The replies received indicate that, with few exceptions, the communities heard from were ill-prepared for the care of these cases. In most instances they were treated in general hospitals, insane asylums and county homes; in some localities special temporary provisions were made while in others prisons and dispensaries appeared to be the only available means of relief.

The small number of addicts treated is of interest. Of the 40 cities replying to this question, in only 22 were the correspondents aware that any had received public assistance and in these instances the number cared for fell far short of the number one might have expected to find, even according to the most conservative estimates. This may be due to several causes, overestimation of our addict population; varying degrees of enforcement of the law and, not least, I am inclined to believe, "leaks" in the law itself. This will be referred to later.

Replying to the query—"Is it your opinion that the Harrison Act meets all the requirements of an act designed to suppress the improper use of opium derivatives and cocaine," 9 replies were "Yes," 28 "No," 8 correspondents were in doubt and 7 uninformed. That 50 per cent. should consider the Act not adapted to its obvious design, is significant, even though we bear in mind that a proportion of criticisms may be ill-founded.

As to the nature of its weak points, 26 specified the exemptions contained in Section 6 of the Act; 8 that physicians were allowed too much latitude; 7 that existing addicts were not provided for (this objection is satisfactorily covered, however, by a ruling of the Commissioner of Internal Revenue under date of May 11). Others suggested that physicians who were themselves addicts needed special control; that copies should be kept of all prescriptions to prevent "raising" (this has occurred in several instances to my knowledge) and that physicians with "bad records" should be denied registration.

The first criticism given, that of the exemptions of Section 6, seems to be quite well sustained by our knowledge of both the etiology and nature of drug addictions. As Wilbert, whose work evidences a most careful and judicial study of this problem, states—"it may be said that it is not generally realized that the taking of even small doses of opium or morphine at regular intervals for a continued length of time will be more likely to develop the opium habit than the occasional indulgence in larger quantities" and further, after quoting Pettey to the effect that the average person will develop an addiction after 30 days of daily use of opium or one of its alkaloids—"With these several possibilities fairly well established, it would appear to be unfortunate to endorse or even countenance exception clauses in anti-narcotic laws." (Martin I. Wilbert, Public Health Reports, Vol. 30, No. 32, p. 2294.)

Granting that the employment of narcotics should be restricted to skilled administration, it is difficult to reconcile the exemptions which permit the sale of preparations containing an amount quite sufficient for physiologic effects, to be sold over the counter at the option of every drug clerk. That the amount of opium or its alkaloids in such preparations is limited, presents merely a distinction of degree, and in view of the actual workings of the law, in this particular as we shall see later, the question of degree, even, is more theoretical than practical.

Considering another alleged weak point in the Harrison Act, that physicians are allowed too much latitude in dispensing these drugs, I believe that there can be little doubt on this point. Paragraph A, Section 2, of the Act provides that physicians shall keep a record of all such drugs dispensed or distributed, etc., except such as may be dispensed or distributed to a patient upon whom such physician shall "personally attend." Under Article 10 of the regulations the phrase "personally attend" is defined as "personally visit," *i. e.*, the physician must be absent from his office. Here is a quite evident "leak," as, in the absence of records of such dispensings, it would be impossible to check the amounts of these drugs used by physicians with their official purchases and amounts dispensed to office patients could easily be accounted for as dispensed during outside visits. That the law has been evaded in this manner is common knowledge.

Again, under date of May 11, a ruling is made stating that where unusual quantities of these drugs are prescribed for the cure of habit that they shall show a decreasing dosage from time to time, as an evidence of good faith on the part of the physician. This is right and proper as far as it goes, but apparently no means are taken to guard against one addict being thus "treated" by several physicians at the same time or by one physician after another. Such evasions are quite simple and have occurred in Jacksonville. Unless more control is exercised over this method of "treating" cases of drug addiction, many will carry their habits for an indefinite period without serious inconvenience.

Again, it is well established in the bibliography of drug addictions that physicians who are themselves users are notoriously careless in the dispensing of these drugs, yet so far as I am able to discover such physicians may register and pursue their dangerous practice unhindered.

Question 9 related to the sale of paregoric since the passage of the Harrison Act as this preparation has been ruled "exempt" under Section 6. It was stated in 21 replies that the sales of this preparation had increased, in 17 that they had not, while 6 correspondents were doubtful and 9 uninformed. In my own locality the increase has been very marked and many instances of evasion of the intent of the law, through this means, have come under our notice.

Not only may an addict of morphine or other opium derivative be maintained in comparative comfort by the use of paregoric, but it is not at all uncommon to find addicts who have acquired their habit through the continued use of this preparation of opium. By the exercise of a little circumspection, as to the frequency with which they purchase it from any one druggist, such individuals are in nowise affected by the Harrison Act.

Question 10 seeks the same information as the preceding, but with relation to patent medicines, *i. e.*, whether or not their sales had increased since March 1. The replies

received were "Yes," 8, "No," 27, doubtful and uninformed, 15.

Question 11 reads: "Does the general run of legitimate prescriptions of physicians contain less of opium derivatives now than before the enforcement of the Harrison Act?" It was desired to determine, through the replies to this query, whether or not the Act might have had any deterring effect on the careless and unnecessary use of narcotics. The replies would certainly indicate that such had been the case and that the law, in this respect at least, had exerted a powerful suggestion for greater caution in the employment of narcotic drugs. Thirty-eight replied "Yes," 4 "No," while 9 were doubtful or not informed.

In this connection a pharmacist, Mr. W. D. Jones of Jacksonville, went over his prescription files at my request and compared the number of prescriptions containing narcotic drugs for the months of July, 1914 and 1915, before and after the passage of the Harrison Act. In 1914, of 1,650 prescriptions compounded during the month of July at this drug store, 155 or 9.3 per cent. contained opium derivatives or cocaine. In 1915, for the month of July, of 1,686 prescriptions compounded, 180 or 10.9 per cent. contained narcotic drugs. No prescriptions for addicts were counted, the figures given representing the normal run of prescriptions both for external and internal use.

In this connection Mr. Jones states it to be his observation that there has been a gradual but constant increase in the use of narcotic drugs for the last ten years. He considers the increase noted to be about normal and is of the opinion that the Harrison Act has not affected the prescribing of these drugs, as would be indicated from the replies noted above. He further states, as have several other druggists, that immediately after March 1 there was a decrease in the number of prescriptions containing narcotics but that since the medical profession have become more completely familiar with the law that this decrease has ceased to be noticeable. This is a matter for further investigation.

That the Harrison law marks an important period in the story of narcotism in this country and is an evidence of a sorely needed, if belated, awakening on the part of Congress, no one may question. That it will control many of the more flagrant means of distribution of these drugs and that, through the control of interstate traffic especially, it will prove of the utmost assistance in the enforcement of state laws is evident.

On the other hand it would appear, from the foregoing and other examples of weakness which might be added to the list, that it falls far short of adequate control of the situation in many of its phases. In fact about the most that can be said for the law is, to quote from Wilbert again, that "In the Federal anti-narcotic law we have the possibility of an accurate survey of existing conditions in connection with the use and abuse of certain narcotic drugs. The findings, if they can be made a matter of record, will place the

blame for the illicit use of the proscribed drugs where it rightfully belongs and will suggest ways and means for correcting existing abuses."

Dependent as the Act is for any great degree of efficiency on the widespread coöperation of the medical profession, it is much like many state laws which have evidenced their inadequacy in the past. Experience has conclusively shown the futility of looking to the medical profession for the solution of the narcotic evil and, until legislators, both state and national, come to realize this fact and take cognizance of it in anti-narcotic enactments, a continuance of the abuses of the past may be expected.

SUMMARY OF STATE LAWS AND RULINGS RELATING TO THE PREVENTION OF BLINDNESS FROM BABIES' SORE EYES.

Blindness from babies' sore eyes (ophthalmia neonatorum) would practically never occur if a prophylactic were used in the eyes of every infant immediately after birth, and if every case of redness, swelling and discharge from the eyes of infants were promptly and adequately treated.

The prevention of blindness from this cause depends entirely on the education of the general public to its dangers, and the use of a prophylactic in every baby's eyes immediately after birth—by the physician, midwife, or nurse in attendance. In addition to widespread publicity, certain legal provisions are necessary to accomplish the desired result. To ascertain how far these provisions exist in the various states, the National Committee for the Prevention of Blindness has made a study of those state laws and regulations which relate to the control of ophthalmia neonatorum. A tabulation of the provisions of these laws is as follows. County and city acts, ordinaces and rulings are not included.

This material, briefly summarized, shows the following:

1. The reporting of babies' sore eyes to the local health officer or to a physician is compulsory in 37 states.

2. The reporting law is printed on the birth certificate in 7 states.

3. Local health officers are authorized and required to secure medical attention for uncared-for cases, or to warn parents of the dangers and advise immediate treatment in 21 states.

4. Births are reported early enough to be of assistance in prevention of blindness work in 11 states.

5. The question as to whether or not precautions were taken against ophthalmia neonatorum is included on the birth certificate in 14 states.

6. Free prophylactic outfits are distributed to physicians and midwives in 16 states.

7. The use of a prophylactic as a routine is compulsory in 15 states, and strongly recommended in an additional 5 states.

8. Popular educational leaflets, relating in whole or in part to prevention of infantile blindness, are distributed by State Departments of Health in 20 states.

The first statutory requirement which should be made by all the states would seem to be compulsory reporting of all cases of babies' sore eyes to the local health officer, with a penalty attached for not doing so. Medical attention could then be provided for all uncared-for cases, while the information secured regarding babies who are attended by physicians, as well as those who are not, would be valuable in showing the frequency with which this disease occurs, and the frequency with which injury results from its neglect.—*Monthly Bulletin, Boston Department of Health.*

THE GRADING OF MILK IN SMALL COMMUNITIES.

LINSLY R. WILLIAMS, M. D.,
Deputy Commissioner of Health, New York State.

Read before a General Session of the American Public Health Association, Rochester, N. Y., September 7, 1915.

The New York State Health Department last year enacted a Sanitary Code which regulates the sale of milk in every rural community in the state. Doctor Williams tells something of how it has worked.

COMPARATIVELY few small communities in this state, at least, had made much progress toward the grading of milk prior to November a year ago. A large number of these communities, however, had enacted ordinances for improving the sanitary quality of the milk supply. These ordinances were inadequate and in no instances complete, but there were many excellent individual ordinances, such as the prohibition of the sale of dipped milk; the license or issuance of permits to dealers; the definite limits of temperature at which milk may be kept, and so on.

Notwithstanding its limitations and the somewhat arbitrary methods used in scoring, the grading of a milk supply is by far the most satisfactory method of improving the sanitary quality of the milk supply of a community. It brings advantages not only to the consumer but also to the dealer and producer.

For a number of years the three first-class cities in the state of New York, that is, those cities having a population of 175,000 and over, New York, Buffalo and Rochester, have kept the milk supply under a satisfactory system of supervision.

In the seven second-class cities of the state, that is, those cities having a population of 50,000 to 175,000, no systematic work of grading of milk supply was carried out prior to the adoption of the chapter on Milk and Cream of the New York State Sanitary Code in November, 1914, excepting in the city of Syracuse. I again call particular attention, especially to the health officers of this state, not to confuse the excellent milk ordinances adopted in various cities of the state with the definite system of grading milk.

In the smaller cities of the state, those having a population of less than 50,000, of which there are 47, only two made any definite attempt to grade their milk supply prior to the adoption of the Sanitary Code. In the villages and smaller communities it was rather exceptional to find a progressive health officer who had made definite progress in the improvement of his local milk supply.

The effect of the adoption of the Sanitary Code of the State of New York upon milk and cream made a notable advance in the improvement of the milk supply throughout the state of New York. These regulations

contained nothing new to those familiar with the present-day control of milk supplies, and they charged every municipality with the duty of supervising its milk supply through its health officer and his agents. These regulations consist in the inspection and scoring of dairies, and the classification of the milk into grades, according to the dairy score and bacteriological count. The tuberculin test and bacteriological count are required for certified and Grade A milk, and physical examination, excluding tuberculous cattle, for Grade B milk.

It may not be surprising to know that these regulations were openly opposed by a number of producers, grangers and municipal officials, the opposition being based upon the usual argument that such supervision is unconstitutional, unnecessary and expensive and the producer does not receive an adequate price for his milk.

It is our opinion that the opposition really arises from a lack of appreciation of the dangers which may arise from milk and the advantages which come from grading. Unfortunately, many of our citizens can learn only from personal experience. The enforcement of these regulations, especially the proper grading of the milk, is a matter of extreme difficulty for the health officer, especially in smaller communities, because of the lack of public and official support. The health officer in the smaller communities is nearly always a practising physician, and it is a difficult matter for him to insist upon his patients or his political friends or backers living up to the requirements of the milk code, if any of these persons happen to be producers of milk.

The small community has long experienced one great advantage in its milk supply, and that is that the milk supply is produced locally and reaches the consumer usually within twelve hours of milking time. On the other hand, the small community experiences a marked disadvantage on this very account. The producer takes his milk in cans in a wagon directly to his consumer—usually uniced—and dips it from the can into a receptacle furnished by the consumer. Another difficulty arises in the production of milk in small communities within the city or village limits—the adequate control of a dairy from one to five or more cows owned by a citizen for his personal use, and the disposal, for a part or perhaps all of the year, of his surplus supply. This has raised the question as to whether this small owner is or is not a milk producer. The Department has ruled in these instances that this individual is not a dealer, although what future action may be taken in this regard has not as yet been determined. Two small communities* in the state took definite action in the grading of milk prior to the adoption of the milk code, so they deserve special mention. Full credit, however, should be given many of the communities in the state, too numerous to mention, who during the past five years have markedly improved the quality of their milk supply.

In the village of Saranac Lake, a community of 5,000 inhabitants, a

* Tarrytown also adopted a system of grading prior to November, 1916.

TABLE I.

Name.	Score.			Bacteriological count.		
	1911.	1912.	1913.	1911.	1912.	1913.
Wm. Ryan	61	72	96	6,600	22,400	4,933
Judd Kelley	69	*	*	21,500	*	*
Chas. Morehouse	36	54	83	34,000	97,000	15,250
Harry McConnell	69	64	76	36,000	36,000	12,833
I. R. Works	66	65	85	38,000	105,000	20,234
Meadowbrook Farm	86	87	95	50,300	50,300	5,100
Wm. Betters	57	49	82	55,000	101,000	38,833
John Tierney	47	21	81	102,000	175,000	30,767
T. Frasher	38	30	81	132,000	229,000	29,000
L. W. Durgan	60	65	95	240,000	451,000	32,780
A. H. McKillip	68	33	87	39,000	57,000	14,300
Hugh Morgan	52	23	91	40,000	85,000	18,733
E. Curran	50	70	92	73,000	137,000	21,366
Wm. Kelley	27	32	*	98,000	282,000	*
J. H. Morgan	33	24	50	108,000	267,000	249,467
Oscar Manning	30	20	*	240,000	880,000	*
Geo. Sweeney	†	15	*	502,000	570,000	*

* Out of business.
† No score made.

definite advance was made in the improvement of its milk supply through the efforts of one of the bacteriologists of the Saranac Lake Laboratory. At the beginning of the summer of 1911, bacterial counts were made of the milk of 17 dairies, and the dairies were scored at the same time. No definite effort was made to grade this milk until after the preliminary work had been done. The bacteriologist who made the counts and the scores also had personal interviews with each dealer and pointed out to him the reasons why he should make an effort to improve his supply. The counts and scores made in the Summers of 1911, 1912 and 1913 are given in the above table. (See Table I.)

You will note that several of the dealers who had poor scores and high bacterial counts went out of business, and that a number made marked improvement, both in the score and bacterial counts of their milk.

You will note that the Meadowbrook Farm Company had, in August 1911, a score of 86 with 50,000 bacteria; in August 1912, a score of 87 with 50,000 bacteria; August 1913, a score of 95 with 5,000 bacteria. Morehouse, in August 1911, had a score of 36 with 34,000 bacteria; August 1912, a score of 54 with 97,000 bacteria; August 1913, a score of 83 with 15,000 bacteria. Durgan, in August 1911, had a score of 60 with 240,000 bacteria; August 1912, a score of 65 with 451,000 bacteria; August 1913, a score of 95

with 32,000 bacteria. Wm. Kelly, in August 1911, had a score of 27 with 98,000 bacteria; August 1912, a score of 32 with 282,000 bacteria; in 1913 he went out of business.

As a result of this preliminary work, and through the continuous efforts of the health officer of Saranac Lake, Dr. C. C. Trembley, and the bacteriologist, Dr. John A. Smith, now Sanitary Supervisor in the State Department of Health for the Adirondack district, and Mr. C. S. Thurston, the Board of Health of Saranac Lake Village adopted milk ordinances on April 15, 1913, over a year before the milk chapter of the Sanitary Code of the state was adopted. This ordinance graded the milk to be sold in the village of Saranac Lake into three grades very similar to that adopted later by the State Department of Health.

That such work was possible for a small village is no doubt due in part to the fact that a number of the inhabitants of Saranac Lake, through their experience with tuberculosis, have become interested in the public health propaganda and have lent their support and coöperation toward the improvement of conditions within the village. It would also seem that such work could not have been accomplished without the use of a laboratory, which demonstrated again that bacterial counts are usually in proportion to the dairy score.

In the year 1909 the board of health of the city of Ithaca, frequently spoken of in this state as the model board of health (the board of health of Ithaca consists of Mayor Thomas Tree, president; Mr. W. O. Kerr, secretary and registrar; Dr. H. H. Crum, health officer. Other members are as follows: H. B. Besemer, Prof. W. A. Stocking, Prof. V. A. Moore, Fred D. Van Order, H. L. Stewart and John Collins) undertook steps to improve the milk supply. The milk was graded on the basis of bacteriological counts and on the standard score-card. On the bacteriological standard, excellent equals 10,000 or under; good equals over 10,000 and under 50,000; fair equals over 50,000 and under 100,000; poor equals 100,000 plus.

Two noteworthy features of the supervision of the milk supply in Ithaca consist of a physical examination of all the dairy cattle supplying milk to the city. No definite effort has been made to have the herds tuberculin tested, three only having been so tested, but many undesirable cattle have been eliminated by means of physical examination. The other important feature consists in the publication of the dairies, giving the bacteriological count and grading for that month. This is published as a bulletin for the use of the consumer. The following table shows the number of dairies and their scores:

Number.	Per cent.	Score.
29	23.77	75
55	45.09	60–75
34	27.87	40–60
4	3.27	40–

The average bacterial counts for the year 1915 of 22 dairies show that five dairies have had less than 10,000 bacteria, eight had a count of 10,000 to 50,000; five had a count of 50 to 100,000; and four had a count of over

100,000, of which 445,000 was the highest.

The milk supply of Ithaca being in such a satisfactory condition, this municipality was allowed to continue to maintain its new system of grading, in accordance with Regulation 13, Chapter III of the New York State Sanitary Code. The character and excellence of this milk supply cannot be passed over without pointing out the fact that the Dairy Division of Cornell University and the Cornell School of Veterinary Medicine have played an important part in the improvement of this milk supply, and that, without this stimulus and the additional advantage of the Cornell University Laboratory, the bacteriological counts would not have been made, nor could a bacteriological standard have been put into effect.

In Rockland County a number of municipalities have contracted with a local laboratory to examine and score the dairies, and a marked improvement of the scores and bacteriological counts made has been noted in these localities. Nine dairy farms scored in West Haverstraw at the beginning of the year gave an average of 46 points. These same dairies were recently scored, and averaged 59.8 points. Twenty-five dairies supplying the village of Haverstraw scored at the beginning of the year, averaged 48.5 points. At the recent scoring they averaged 61.5 points. Eighteen dairies in Congers scored at the beginning of the year, averaged 54 points; at the recent scoring the average was 60 points. Twenty-four dairies in Nyack scored at the beginning of the year, averaged 48 points; at the present scoring the average was 60 points. Nine dairies at Piermont scored, at the beginning of the year, averaged 56.5 points; at the recent scoring 70 points. Six dairies at Stony Point, scored at the beginning of the year, averaged 45 points; at the recent scoring 64 points. Thus we have a total of 90 dairies averaging at the beginning of the scoring 49.5 points, and at the recent scoring averaging 62.5 points.

This satisfactory work is limited, and conditions in other small communities are far behind this in grading of the milk supply. For example, a small city near Albany has inspected several dairies and scored them, but no definite grading of the milk has been done, nor has anything definite been done other than to grant permits for the sale of milk.

In this city of about 11,000 population, the milk is supplied by ten dealers, by two large companies who sell bottled milk in small amounts, and by three other dealers who sell most of their supply in the city of Albany. The score of these ten dairies, giving each dairy considerable leeway on the score, is as follows:

Name.	Score.	Name.	Score.
C. H.	23.5	J. R.	45
M. O.	63	C. G.	40
J. V. E.	64.5	F. B.	75
R. H.	67.5	C. C.	52
J. H.	62	C. W.	51
G. W.	79	J. M.	80.5
A. R.	42.5	L. C.	71
J. M.	80.5	A. P.	66.5
J. S.	72.5	J. T.	65.5

These scores were made by a representative of the State Department of Health, and are quite a little lower than the scores made by the local health officers. This city receives from these dairies 558 gallons of milk a day. All this milk is dipped milk and all is Grade C. A considerable amount is sold from grocery stores and not under the best sanitary conditions. The small amount of bottled milk is of Grade A pasteurized and Grade B, respectively. None of the milk sold in this city is labeled according to grade, with the exception of that of the bottled milk, which is properly labeled.

A number of other small cities and villages have commenced to grade their milk supply, and the health officers are making honest efforts to improve the situation. The problem, theoretically, is a simple one. The health officer of a village could inspect, score and grade all the dairies in his district within a month's time. The practical difficulty consists in getting the people to realize the importance of grading the milk supply, and to have them demand that their milk be labeled Grade A, B or C. The scoring of dairies and the issuance of permits has, to a large extent, been done, but the labeling of cans and bottles is as yet far from being satisfactorily performed.

Through the kindness of the New York Milk Committee, a table was prepared for me several months ago, giving the milk ordinances for a number of cities with a population from 1 to 10,000; 10 to 50,000; 50 to 100,000; and 100,000 and over. For this excellent tabulation I desire now to express to the Committee my thanks.

In the cities of Bellevue, Ohio, Ft. Scott, Kansas, Albuquerque, New Mexico, Warren, Pa., Vallejo, Cal., Lake Charles, La., Southbridge, Mass., Holland, Mich., Long Branch, N. J., Piqua, Ohio, and Cairo, Ill., having a population of from 5,000 to 14,000, all have ordinances controlling the sale of milk. None of these ordinances, however, require any grading or classification of the milk. Long Branch alone requires a minimum dairy score and none require labels.

Of these eleven cities, four require tuberculin test, two of which also require physical examination of the cattle, and four more require physical examination. Seven, however, require bacteriological standards, Holland, Mich., having a minimum standard of 200,000; Cairo, Ill., 300,000; Bellevue, Ohio, Albuquerque, N. M., Southbridge, Mass., and Piqua, Ohio, 500,000. Long Branch has a minimum standard of 1,000,000 before pasteurization and 50,000 after pasteurization.

The sale of dipped milk is prohibited in Piqua, Long Branch and Holland. In no instance is the producer required to have a permit, but in all but three instances the dealer is required to have a permit. Seven have a minimum temperature standard—60 in three instances; 50 in four instances. Four have no temperature standard.

The advantages of grading milk are great, as has already been pointed out to you today. The actual amount of work to grade a supply is not so great, nor is it expensive. Opposition

is naturally made and can only be overcome by education. The health officer must appreciate the advantages to be obtained and if personal conferences with the milk dealers are held, at which representatives of the State Departments of Health or Agriculture, or from the Dairy Division of the Federal Department of Agriculture attend, considerable progress can be made in dispelling the fears of the producers.

In this state an effort has been made, through various members of the Department, to call together meetings of local dealers and advise them the meaning of the regulations which require the grading of milk. This method has been unusually successful in a number of instances, and milk has been graded in a number of our small communities.

The two small communities selected and spoken of at some length in this paper were chosen because of the work which had been done toward grading the supply before the adoption of the State Milk Code. Progress is being made in almost every locality, and the Department feels encouraged with the way in which the health officers have tackled this problem, which to a large number of them was wholly a new one.

It would not be possible to mention all the incorporated villages and smaller cities which are now actively carrying on a campaign for the grading of their milk under the efficient direction of the health officer, nor would it be practicable to give a detailed statement of the work of grading milk throughout the state until November of this year, which completes the first year of work after the adoption of the State Milk Code by the Public Health Council.

◆

HEALTH INSURANCE IN THE PREVENTION OF TUBERCULOSIS.

Nearly fifteen hundred anti-tuberculosis associations in almost every part of the United States will be asked to participate in a campaign for health insurance legislation by the American Association of Labor Legislation, according to an announcement made recently from the headquarters of the National Association for the Study and Prevention of Tuberculosis. Bills asking for health insurance legislation will be introduced in more than twenty states during the coming fall and winter and the support of the anti-tuberculosis associations and other public health organizations will be urged for these bills.

The anti-tuberculosis associations are counting upon health insurance as an aid in controlling the spread of tuberculosis, because it will provide machinery first of all to discover the cases that cannot now be found by ordinary methods in vogue, and secondly it will help to secure the much needed medical care in hospitals and sanatoria that will check the ravages of this disease. But more than these, the anti-tuberculosis workers are looking to health insurance as an aid in promoting periodic physical examinations in all industries, which the National Association for the Study and Prevention of Tuberculosis believes would be one of the greatest preventive measures that can be introduced in this country.

At the present time, tuberculosis is the greatest single cause of death and it is also the most difficult of all diseases to detect. Under a system of health insurance, which would necessarily presuppose regular examinations at periodic intervals of all workers, both the employer and the employee, as well as the state, would be interested to see that this disease was discovered before it had developed too far.

The proposed bills provide for participation of the worker, the employer, and the state in the insurance fund and also provides for the adaptation of the scheme to already existing benefit agencies under state supervision. The health insurance laws will cover every worker earning $100 a month or less.

THE RÔLE PLAYED BY THE PUBLIC HEALTH NURSE IN THE CONTROL OF COMMUNICABLE DISEASES.

CHARLES J. HASTINGS, M. D.,
Medical Officer of Health, Toronto, Canada.

Read before the General Session, American Public Health Association, September 10, 1916.

WHEN I was asked to present this phase of the problem, I was prompted to comply with the request, in view of the fact that probably nine-tenths of the efficiency of all public health work is educational. We have heard a good deal about printer's ink and its value in regard to public health administration and public health education, but while we all appreciate the value of education through this channel, yet, we also realize the fact that there is a limited portion of the population of any large urban centre that can be reached and educated through the medium of printer's ink.

In the first place there are tens of thousands of the people in all large urban centres such as New York, Philadelphia, Chicago, and even Toronto, who cannot read. There are still thousands of others who can read but do not read and tens of thousands who read but do not think. Therefore, there must be some other means by which we can get in touch with these people for obviously these are the citizens that require education the most. We must get nearer to them; we must get into their homes, and this can best be accomplished through the medium of the public health nurse.

The qualifications of a public health nurse, in addition to her training in a well-recognized school for the training of nurses and the holding of a diploma therefrom, require her to be a tuberculosis nurse; a child welfare nurse; a school nurse; a social agent; and to be trained in hygiene and sanitation. The training in social service must be of such a character as to make her an efficient social service agent. In fact, she must be the home-maker, caring for the race from the prenatal state until it passes on to the next cycle of existence. Heretofore children have been neglected until they enter school, before which, ofttimes, irreparable damage has been done.

Any efficient campaign against communicable disease must be directed along two distinct lines: First, the preventing of germs from gaining access to the body; second, the building up and maintaining of the resisting powers of the body. That this may be effectively carried out, the public requires to be educated, for upon the degree of efficiency of this education depends largely the permanency of our work in preventive medicine. The knowledge of the sources of disease, and the various ways and means by which it is transmitted from one person to another for years has remained, for the most part, within the precincts of our universities and laboratories. This knowledge must be democratized or translated into language that can be assimilated by the housewife in the humblest home and by the man on the street.

Obviously, this can best be accomplished by the public health nurse—she having already won the confidence of the home. By rendering a service in it she can secure a hearing that no one else could. With her knowledge of the haunts and habits of disease-producing germs and of how they are transmitted from one person to another, in conversation with the mother she can convey to her this information in a manner that will be acceptable to her and will be properly understood by her. At the same time the nurse can explain the dangers of the mild cases that are unrecognized and, therefore, unreported, and also of the purposely concealed cases, assuring the people that the object of the Department of Health is not to create trouble for them, but to safeguard them against the ravages of these diseases. She can explain to them that prevention is much more economical than cure and can thereby secure a better reporting of cases and consequently a more efficient quarantine.

Probably the best illustration we have of the value of the public health nurse in the control of communicable disease is the work that has been accomplished by her in the campaign against tuberculosis. Take for instance my own city. In 1911 Toronto had 59 patients in the hospital for advanced cases of tuberculosis and 7 in the Muskoka Hospital for the earlier cases. These two sanitaria now have 225 and 350 cases respectively. This is largely due to the fact that, in addition to our having legislation in force requiring the reporting of all cases of tuberculosis, our nurses, by attending the various tuberculosis clinics and following the cases to the homes, have been brought in contact with and have heard of numbers of other cases. The cases reported are not more than one-half as many as those that have been hunted up and discovered by the nurses in the field work. They attend the tuberculosis clinics; follow the cases to the home; make careful investigation of home conditions and advise the mother in regard to the danger of transmission of tuberculosis from one member of the family to another, and how to prevent or overcome this danger. At the same time they emphasize the fact that the same precautions and the same instructions apply to all communicable diseases. Moreover they make observations in regard to the social conditions in the home. The father is probably out of work—that means a decrease in the revenue of the home by probably one-half. Probably the mother has to become the sole bread-winner. In addition to the decrease in revenue, this means the depriving of the young children in the home of the mother's care, which probably means that the mother has to wean her baby. This deprivation ofttimes entails irreparable damage.

These conditions when found by our nurses are reported to the proper social agencies for correction. The Department of Public Health does not give financial help, but coöperates with the social agencies which can do the constructive work in the home. Material relief as part of a constructive plan is frequently given by the social agency. The Department is concerning itself not only with preventing the transmission of disease, but also with maintaining normal conditions of living.

At present our nurses have 7000 homes under supervision. The opportunities for the nurses to reach the homes as welcome visitors are constantly increasing. One of the most valuable opportunities is that afforded by the hospitals. Gradually the follow-up work has been undertaken for those hospitals which have not organized social service departments of their own. The individual social problem is referred by the Department to the local social agency and by united efforts the patient, when discharged from the hospital, is readjusted to his environment.

It must be clear to all of us that if we are going to efficiently administer the principles of preventive medicine we must get back to the social problems of the home, and we must see that the revenue in the home is such as to make it possible for these people to be properly and sufficiently nourished and properly housed.

The public health nurse should be equipped in personality and training to teach the sources and modes of infection and to secure in her neighborhood the conditions of living which establish physical resistance to disease. As a teacher she is welcome because she has become known in the homes in their times of need and having shared the experiences of the home and of the neighborhood, she teaches in the language of their experience.

WHAT OHIO IS DOING TO CONSERVE LIFE IN THE INDUSTRIES.

VICTOR T. NOONAN,
Director of Safety, The Industrial Commission of Ohio.

Read before the Industrial Hygiene Section, American Public Health Association, Rochester, N. Y., September 10, 1915.

THE State Industrial Commission of Ohio, which handles state compensation for workmen killed or injured in industrial occupations, is carrying on an aggressive educational campaign to conserve the lives and limbs of the industrial workers of the state. It was realized that the mere enforcement of state factory laws and the guarding of machinery would not put an end to the tremendous number of accidents occuring each year in the state, as it was found that the human factor—the man himself, was responsible for at least 50 per cent. of the accidents. So it was deemed necessary that the man himself, the employer, the superintendent, the foreman and the workman should be educated to the important fact that the human body is the most perfect, the most wonderful of all machines, and that this human machine must be cared for and protected first.

Just a year ago this educational campaign was inaugurated. In that time I have made more than five hundred talks in as many factories throughout the state. In these talks the value of a human life, the wonders of the human body, the wonderful power of sight and touch and hearing, the marvelous power and ability of the human hands have been brought home to the workman. Motion pictures have also been used with good effect. The result of this direct personal appeal to the workmen has been very great, and in all the workshops where this educational work has been carried on, both employers and workmen have since shown much enthusiasm and coöperation in the prevention of needless accidents. Where possible the children of the workmen in the schools have also been enlisted in Ohio's efforts to conserve the lives and limbs of its great army of industrial workers.

Ohio was the first state in the country to inaugurate an industrial safety exposition, the first annual exposition being held last January at Columbus. One hundred and fifty companies and corporations from every section of the country, including the railroads and steel corporations, had exhibits, illustrating not only the best methods of accident prevention, but also industrial hygiene and sanitation. This exposition was not commercial in any sense, but highly educational. The second annual safety exposition of Ohio will be held in Central Armory in Cleveland, January 22 to 30, 1916, when at least two hundred and fifty companies will be represented with exhibits as well as many

other states and public health departments. It will be formally opened by the governor of the state.

Under direction of the Industrial Commission of Ohio, new laws for factories and workshops are now being formulated by committees of employers and workmen. Under the old plan such laws were made by the legislators; under the new system, the employer and the workman become the legislators of their own factory laws. The new codes now ready for the approval of the Industrial Commission will give increased protection from mechanical dangers, better ventilation, greater light, purer air and healthier sanitary conditions. In a word, the workingman and the workingwoman in Ohio stand today on the threshold of healthier and happier working conditions and with a new and higher appreciation of the value of their lives and limbs.

Civilization is judged by its regard for humanity. In our modern American civilization today, there is a new spirit—the spirit of prevention. You ladies and gentlemen who are here today from many sections of this great continent know what that spirit is. It is the spirit of love, a spirit filled with mercy, kindness, sympathy, tenderness; it is that spirit which fills your hearts, which gives you courage and optimism in your efforts to prevent disease, to make the sick well, to save life and to promote happiness.

The value of a human life is not to be measured in dollars and cents; the value of life is measured in the joy of fatherhood and motherhood; the value of life is measured in the smile of the innocent babe, so likewise is it measured when death takes the one that is loved. The value of life is measured in laughter and tears, in joy and suffering, in gladness, affection, friendship and family ties and in all the sweet memories that lie hidden in every heart. When life is valued in this way, your work and mine will become a song which will reëcho through the corridors of time.

PUBLIC HEALTH PURCHASABLE.

A committee of the American Association of Labor Legislation has estimated that each one of the 30,000,000 wage earners in the United States annually loses nine days through sickness, as an average. This is a total of 270,000,000 days lost to production.

If only one individual could be the goat, and were willing to gather into his own tissues all the pain, anguish and hardship which these figures represent, that individual would be the greatest benefactor imaginable and would be at the job over 750,000 years.

The financial loss to the worker for medical care in these 270,000,000 sick days has been put at $6 per capita.

The proper remedy lies not so much in sickness insurance, for somebody has to pay that, but in improved methods and better conditions of living, so that each of the 30,000,000 may cut down the sick days to a minimum.

This can come only through more uniform intelligence regarding the foes of health, more interest in the means for fighting them and better actual practice of the laws when they are known.

If the 2,500,000 people in Chicago would resolve to tax themselves at a total average annual rate of $1 each, for maintaining community health through the effort of their department of health, they would go a long way toward saving the $6 per capita loss sustained by the wage earning class of the community, which is the most important part of that community. This is a good business proposition.

The city of Buffalo does better; it devotes $1.11 per capita annually to its health conservation. Chicago had only 37c per capita during 1915 for this purpose. Is it possible that Buffalo is more intelligent, more public-spirited and more progressive and up-to-date than Chicago with its motto, "I WILL"?

SCARLET FEVER DURING 1915 IN PHILADELPHIA.*

MAURICE OSTHEIMER, M. D.,
Acting Assistant Diagnostician, Philadelphia Bureau of Health.

DURING 1915, 1,072 cases of scarlet fever were reported in Philadelphia, exactly one hundred more than half the number reported during 1914 (1,944); and less than a third as many cases as were reported during 1913 (3,400). This is a morbidity-rate of 63.7 per 100,000, as compared with 117 in 1914 and 208 in 1913. (See Chart I.)

The lowest number of cases was reported during August, only 29 cases; the highest number during December, 147 cases. January, 1915, had only 118 cases as compared with 286 in January, 1914, and 198 in January, 1916. (See chart II.)

The sex of the 1,072 cases reported was male, 529, of whom 513 were boys; and female, 543, of whom 501 were girls. Thus only 58 adults contracted scarlet fever during 1915.

These figures this year are the lowest since 1900, when what we now consider accurate statistics were begun. The figures coming nearest to these are found in 1906, 1,696 cases, and in 1907, 1,893 cases. The highest number of cases in any year was 4,188 in 1903, with

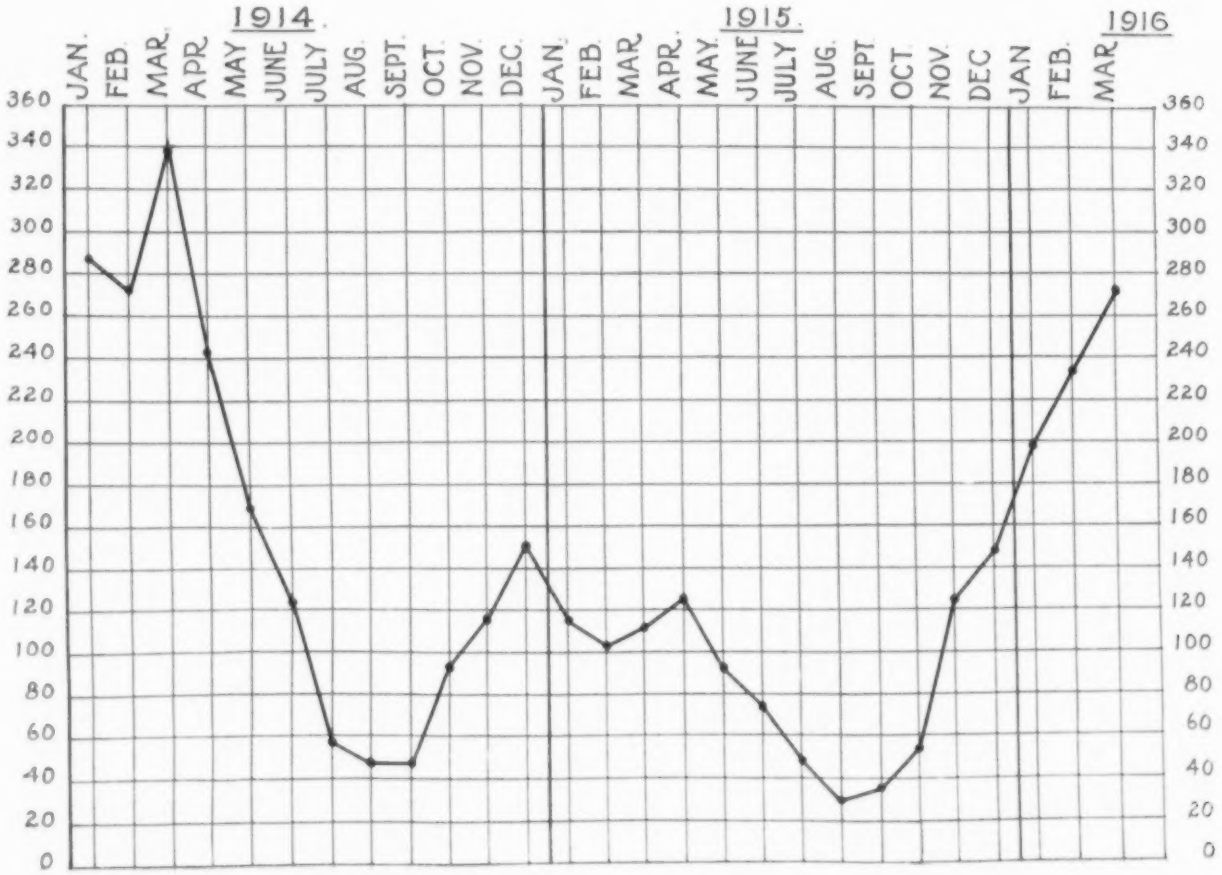
CHART I.

SCARLET FEVER.

	Cases.							
	1908.	1909.	1910	1911.	1912.	1913.	1914.	1915.
Jan.	5 wks. 299	4 274	4 202	4 203	4 114	4 431	286	118
Feb.	4 wks. 260	4 277	4 166	4 180	4 160	4 442	273	102
Mar.	4 wks. 325	4 306	4 148	4 180	5 337	5 559	339	111
1st qtr.	884	857	516	563	611	1,432	898	331
April	4 wks. 270	4 287	5 214	5 250	4 311	4 351	242	142
May	5 wks. 278	5 309	4 185	4 287	4 280	4 406	171	92
June	4 wks. 207	4 199	4 185	5 173	5 265	5 215	118	71
2d qtr.	755	795	584	710	856	972	531	305
6 mos.	1,639	1,652	1,100	1,273	1,467	2,404	1,429	636
July	4 wks. 87	5 129	5 94	4 89	4 115	4 90	58	48
Aug.	5 wks. 89	4 70	4 63	4 83	5 124	5 76	48	29
Sept.	4 wks. 110	4 98	4 71	5 107	4 111	4 87	48	37
3d qtr.	286	297	228	279	350	253	154	114
	1,925	1,949	1,328	1,552	1,817	2,657	1,583	750
Oct.	5 wks. 233	5 186	5 171	4 93	4 187	4 179	94	54
Nov.	4 wks. 243	4 170	4 197	4 120	5 375	5 298	116	121
Dec.	5 wks. 250	5 284	5 229	5 163	4 493	30 d's 266	151	147
4th qtr.	726	640	597	376	1,055	743	361	322
Year	2,651	2,589	1,925	1,928	2,872	3,400	1,944	1,072
Rate, 100,000	177	170	124	122	179	208	117	63.7
	Deaths.							
Deaths	181	133	135	179	113	162	129	26
Rate, 100,000	12.0	8.7	8.7	11.3	7.0	9.9	7.8	1.5
Case death-rate	6.8	5.1	7.0	9.3	3.9	4.8	6.6	2.4

*This paper was read before the Philadelphia Pediatric Society, Tuesday evening, March 14, 1916.

CHART # II SCARLET FEVER BY MONTHS.



3,756 in 1901, 3,740 in 1904 and 3,400 in 1913. (See Chart III.)

The lowest number of deaths from scarlet fever on record also occurred during 1915, only 26 in the entire city, a case death-rate of 2.4 per cent., as compared with 2.9 per cent. in 1905 and 3.3 per cent. in 1906. The highest case death-rate occurred in 1911, 9.2 per cent. The greatest number of deaths recorded was 220 in 1901, with 201 in 1904. The death-rate per 100,000 was but 1.5 in 1915, as compared with 7 in 1912, 7.8 in 1914 and 12 in 1908. (See Chart III.)

The 1,072 cases were reported as follows:

	Cases	Per cent.
On the day of onset in	305	28.5
On the second day of illness in	285	26.6
On the third day of illness in	210	19.6
On the fourth day of illness in	105	9.8
On the fifth day of illness in	64	6.0
From the sixth to tenth days in	51	4.7
From the eleventh to twentieth days in	52	4.8

It is interesting to note that 74.6 per cent. (800 cases) were reported to the Bureau of Health within three days from their onset, as compared with 73.9 per cent. in 1914; and within five days from the onset of the disease 90.4 per cent. of cases (969 cases) had been reported, as compared with 89.8 per cent. in 1914. This prompt reporting of cases, with the early isolation then possible, has greatly helped to diminish scarlet fever in the city. Yet we should not overlook the fact that the case-incidence of scarlet fever varies from year to year, even under the best conditions.

In 112 cases (10.4 per cent.) the patient was well isolated with a trained nurse in attendance; in 279 cases (26.1 per cent.) one member of the family nursed the patient while another acted as housekeeper; but in 681 cases (63.5 per cent.) the same person acted as nurse and housekeeper. Naturally the last figures include most of the patients who were removed, later, to the Philadelphia Hospital for Contagious Diseases.

Girard College furnished the only institutional epidemic during the year, 31 mild cases having developed during two summer months in a building containing about 300 boys aged from 7 to 10 years. There also occurred two small school epidemics, one in a public school (twelve cases in 6 weeks); the other in a parochial school (ten cases in 9 weeks). No cases were traced to milk infection during 1915, which would tend to prove that our milk supply is really well pasteurized.

CHART III.

SCARLET FEVER.

	Cases.			Per cent. cases treated in hospital	Deaths.			Per cent. fatal.		
	Total reported	Treated in hospital. Number admitted during year.	Treated at home.		Total.	Hospital cases admitted during year.	Home.	Total.	Hospital cases admitted during year.	Home.
1900	2,813	717	2,096	25.5	163	94	69	5.8	13.1	3.3
1901	3,756	1,115	2,641	29.7	220	123	97	5.9	11.0	3.7
1902	3,161	673	2,488	21.3	143	56	87	4.5	8.3	3.5
1903	4,188	927	3,261	22.1	189	98	91	4.5	10.6	2.8
1904	3,740	764	2,976	20.4	201	97	104	5.4	12.7	3.5
1905	1,992	586	1,406	29.4	57	37	20	2.9	6.3	1.4
1906	1,696	557	1,139	32.8	56	42	14	3.3	7.5	1.2
1907	1,893	817	1,076	43.2	100	69	31	5.3	8.5	2.9
1908	2,651	1,195	1,456	45.1	181	130	51	6.8	10.9	3.5
1909	2,589	1,574	1,015	60.9	133	112	21	5.2	7.1	3.4
1910	1,925	1,219	706	63.3	135	121	14	7.0	9.9	5.6
1911	1,928	1,245	683	64.6	179	115	64	9.2	9.2	9.4
1912	2,872	1,917	955	66.8	113	87	26	3.94	4.5	2.7
1913	3,400	1,742	1,658	51.3	162	103	59	4.8	5.9	3.6
1914	1,944	1,165	779	59.9	129	77	52	6.6	6.6	6.7
1915	1,072	625	447	58.3	26	21	5	2.4	3.3	1.1

The greatest number of cases occurred in the 39th ward (74 cases), in the extreme southeastern part of the city; with 60 cases in the first ward, just north of the 39th ward; 57 cases in the 42d ward; 53 cases in the 15th ward; and 50 cases in the 22d ward. The rate per 100,000 of population was greatest in the 42d ward (241), with 163 in the 48th ward, 140 in the 47th ward, and 136 in the 39th ward. The 25th, 41st, 42d and 48th wards, in which the population is least dense, stand No. 45, 43, 3 and 17 in the list of frequency of occurrence of scarlet fever; while the 42d ward leads in the rate per 100,000, with the 48th ward next. In both of these wards the density of population is low. The third ward, in which the density of population is greatest, stands No. 37 in the list of frequency of scarlet fever. (See Chart IV.)

The lowest number of cases occurred in the 9th ward, 0; in the 6th ward, 1 case; and in the 10th ward 2 cases; with the lowest rate per 100,000, also, 0 in the 9th ward, 10 in the 10th ward and 16 in the 6th ward.

When the city is divided into six districts, Central, West, South and North Philadelphia, Germantown and Frankford, the local distribution of scarlet fever becomes interesting. Central Philadelphia, with six wards, had 27 cases, an average of 4½ cases per ward; Frankford, with 3 wards, had 21 cases, an average of 7 cases per ward; North Philadelphia, with 21 wards, had 439 cases, an average of 21 per ward; West Philadelphia, with 6 wards, had 160 cases, averaging 27 per ward; South Philadelphia, with 9 very congested wards, had 282 cases, averaging 31 per ward; and Germantown, with 3 wards not densely populated, had 143 cases, or an average of 48 per ward. (See Chart V.)

Although the officials of the Bureau of Health are hard at work trying to trace the source of contagion in each case reported, it seems almost impossible to find the definite origin of the disease in more than about one third of all cases. Each year, however, brings to light more cases of contact. During 1915 there was known contact in school in 100 instances (9.3 per cent.), as compared with 6.6 per cent. in 1914. Other contact, as in homes, moving picture theatres, playgrounds, etc., was discovered in 117 instances (10.9 per cent.).

When the primary case was treated at home, 117 secondary cases (10.9 per cent.) occurred later than 24 hours but within one month after the first case, as compared with 7.9 per cent. in 1914 and 5.7 per cent. in 1913. But only 31 secondary cases (2.9 per cent.) occurred in houses from which a case had been removed to the Philadelphia Hospital for Contagious Diseases, later than 24 hours but within one month after the first case, as compared with 3.9 per cent. in 1914 and 5.9 per cent. in 1913. These figures show a continued increase in secondary cases when the primary case remained at home, and a continued decrease when the primary case had been removed to the Philadelphia Hospital for Contagious Diseases. It is natural to conclude from this that even more cases of scarlet fever ought to be removed to the hospital for treatment.

New cases probably due to the return home of cases discharged from the Philadelphia Hospital for Contagious Diseases, the so-called "hospital return" cases, occurred in 33 instances (3.1 per cent.) as compared with 2.6 per cent. in 1914 and 2.4 per cent. in 1913. A note of warning might be inserted here against allowing children returning from the hospital, or from isolation, after scarlet fever, to mingle intimately with other children for some weeks. It is so easy for these children to become contagious again, if they catch cold. Whenever possible, such children should get away for a change of air.

Late secondary cases, those occurring several months after the primary case, occurred in only 3 instances (0.28 per cent.) as compared with 0.4 per cent. in 1914 and 0.3 per cent. in 1913. Adding together all the secondary cases gives a total of 184 cases (17.2 per cent.) as compared with 14.9 per cent. in 1914 and 14.3 per cent. in 1913. When the cases in which there was known contact are added to the secondary cases, we have a total of 401 cases in which the origin was discovered, 37.4 per cent., as compared with 32.8 per cent. in 1914. This increase proves that better work is being done each year in discovering the source of contagion in scarlet fever.

The number of cases of scarlet fever removed to the hospital for treatment during the past 15 years varied greatly each year. The greatest number of cases removed to the hospital in any one year was in 1912, when 1,917 cases went (66.8 per cent.), the lowest number went

CHART IV.

DISTRIBUTION OF SCARLET FEVER IN RELATION TO DENSITY OF POPULATION, ARRANGED BY WARDS. 1915.

Ward.	Population per acre.	Cases.	Rate per 100,000.	Number in order of frequency.
1	107	*60*	126	*2*
2	143	22	54	21
3	210	7	27	37
4	152	4	18	42
5	83	3	18	44
6	31	*1*	16	47
7	98	11	40	31
8	50	10	72	32
9	20	*0*	*0*	48
10	85	2	*10*	46
11	86	5	43	40
12	122	7	46	36
13	119	17	86	23
14	128	5	26	41
15	70	*53*	112	*4*
16	90	8	49	34
17	109	6	34	39
18	65	13	48	30
19	118	20	38	22
20	97	36	79	11
21	7.8	36	102	10
22	10	*50*	71	*5*
23	16	16	50	27
24	21	19	35	24
25	60	16	38	28
26	61	*48*	87	*6*
27	49	15	62	29
28	71	30	61	15
29	58	31	103	14
30	88	8	27	35
31	68	7	23	38
32	72	24	66	18
33	27	29	56	16
34	18	35	71	12
35	0.5	2	19	45
36	53	33	73	13
37	69	17	74	25
38	19	17	35	26
39	18	**74**	136	**1**
40	8	23	55	19
41	3.9	3	19	43
42	4	*57*	**241**	*3*
43	46	46	106	8
44	52	46	118	7
45	14	10	38	33
46	22	22	57	20
47	73	42	*140*	9
48	5.2	26	*163*	17

in 1905, 586 cases, 29.4 per cent. During 1915, 625 cases were removed to the Philadelphia Hospital for Contagious Diseases, 58.3 per cent.

On the other hand, the greatest number of cases remaining under treatment at home in any one year was 3,261 cases in 1903, 77.9 per cent., while the highest per cent. of cases treated at home in any one year was 78.7 per cent. in 1902. The lowest number of cases treated at home occurred in 1915, only 447 cases, 41.7 per cent.

The hospital death-rate was greatest in 1908, 130 deaths, 10.9 per cent., and lowest in 1915, 21 deaths, 3.3 per cent., which was the lowest per cent. of deaths in the hospital. The highest per cent. of deaths in the hospital was noted in 1904, 12.7 per cent. The death-rate among those treated at home was also lowest in 1915, 5 deaths, 1.1 per cent., while it was greatest in 1904, 104 deaths, 3.5 per cent. The highest per cent. of deaths among those remaining at home occurred in 1911, 9.4 per cent., and the lowest in 1915, 1.1 per cent., with 1906 and 1905 coming very close with 1.2 per cent. and 1.4 per cent. While the death-rate among those treated in the hospital has diminished, the death-rate among those cases remaining at home has decreased even more; and the death-rate for the entire city has fallen during 1915, to the lowest yet on record, 26 deaths, 2.4 per cent.

CHART V.

DISTRIBUTION OF SCARLET FEVER BY DISTRICTS, 1915.

	Cases.	Cases per ward.
1. Central Philadelphia. Wards 5, 6, 7, 8, 9, and 10	27	**4.5**
2. Frankford. Wards 23, 35 and 41	*21*	7
3. North Philadelphia. Wards, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 25, 28, 29, 31, 32, 33, 37, 38, 43, 45, and 47	**439**	21
4. West Philadelphia. Wards 24, 27, 34, 40, 44 and 46	160	27
5. South Philadelphia. Wards 1, 2, 3, 4, 26, 30, 36, 39 and 48	282	31
6. Germantown. Wards 21, 22 and 42	143	**48**

SOME PRACTICAL METHODS OF BACTERIOLOGICAL WATER ANALYSIS AND RESULTS OBTAINED THEREWITH.

AUGUST V. GRAF, *Chemist*, and AUGUST G. NOLTE, *Bacteriologist*,
St. Louis Water Works.

Read before the Laboratory Section of the American Public Health Association, Rochester, N. Y., September 9, 1915.

The authors in this paper discuss the methods employed and the results obtained in the bacteriological analysis of the water about St. Louis, with the view ultimately establishing definite modes of procedure for such analysis.

THERE are, no doubt, at the present time a large number of water works men at sea as to just what media to use in the bacteriological analysis of water. Some are using dextrose broth, some lactose broth and still others are using lactose peptone bile for the detection of gas formers. Few plants are using the same media and methods for determining the presence or absence of B. coli. At some plants counts are obtained on agar, at others on gelatine while at the larger plants counts are obtained on both.

That this condition of affairs is deplorable is beyond dispute, yet we cannot hope to have it altered until the Committee on Standard Methods sets a definite mode of procedure using one certain medium for the detection of gas formers and certain definite media for the determination of the presence of B. coli. There must be no choice left the analyst as to the media to be employed or as to the mode of procedure.

It is in answer to the much called for practical data on the subject that this paper is presented. We wish to give a description of the methods employed and the results obtained in the bacteriological analyses of our local water, not with a view of having judgment passed on its quality but with the idea in mind of giving to all persons interested, the results of the practical application of the methods employed.

We have divided our subject into two parts: Quantitative and Qualitative Analyses.

QUANTITATIVE ANALYSIS.

At the 1905 meeting of the American Public Health Association, the Committee on Standard Methods recommended the use of gelatine as the standard medium for count. In 1911 the change to agar was made and in 1912 the laboratory section passed a resolution advising the use of both gelatine and agar for determining the number of bacteria in water.

Both gelatine and agar media are used in the analyses of our raw and effluent waters. Samples of secondary

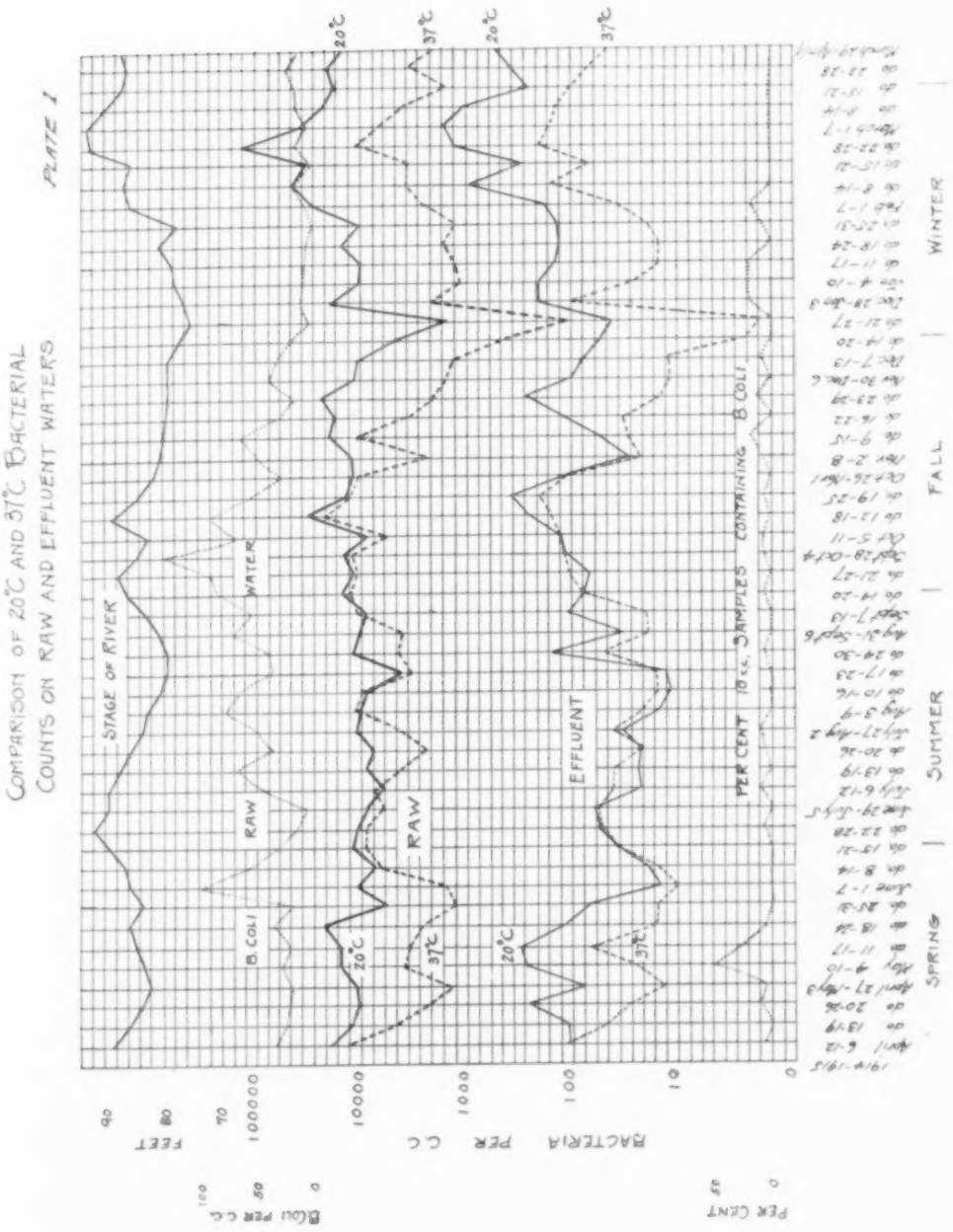
importance are plated on agar alone. The media are made in strict accordance with the 1912 Standard Methods. In the plating of samples two plates are always made from each sample on both gelatine and agar. As a rule two dilutions are used unless better results are obtained from one. The agar plates are incubated at 37° C. for 24 hours; the gelatine at 20 to 21° C. for 48 hours. The average count of the two plates is taken when neither spreader or liquefier has made counting impossible.

Table 1 gives results of weekly averages for the year beginning April, 1914, and ending March, 1915—our fiscal year.

TABLE 1.

WEEKLY AVERAGES FOR FISCAL YEAR 1914–1915.

1914–1915.	Av. stage of river.	Av. temp. of river water.	River water.					Effluent water.					
			No. of samples.	Count.			No. of B. coli per cc.	No. of samples.	Count.			Per cent. of samples containing B. coli.	
				20°C.	37°C.	Ratio.			20°C.	37°C.	Ratio.	10 cc.	1 cc.
April 6–12	88.5	50	11	35,090	20,300	1.7	31	22	132	152	0.9	4.5	0
13–19	85.7	53	9	18,290	7,430	2.5	23	22	143	72	2.0	0	0
20–26	83.6	59	11	12,380	4,330	2.9	21	22	470	54	8.7	9.0	0
April 27–May 3	82.0	64	11	13,530	2,170	6.2	17	21	88	21	4.2	4.8	0
May 4–10	83.0	65	11	27,050	6,220	4.4	26	22	490	38	12.9	50.0	18.2
11–17	84.2	66	11	27,100	5,850	4.6	21	22	540	85	6.4	22.8	9.0
18–24	85.2	67	11	40,800	4,650	8.8	34	20	190	28	6.8	5.0	5.0
25–31	83.4	76	8	7,800	1,970	4.0	18	18	86	27	3.2	0	0
June 1– 7	85.4	78	11	12,090	2,810	4.3	96	22	24	10	2.4	0	0
8–14	86.1	81	11	9,000	8,100	1.1	57	22	34	27	1.3	0	0
15–21	89.1	78	10	15,390	9,640	1.6	30	20	62	60	1.0	0	0
22–28	91.6	81	10	1,560	9,480	1.2	14	20	76	75	1.0	5.0	0
June 29–July 5	88.8	77	8	9,440	8,040	1.2	8	15	80	74	1.1	0	0
July 6–12	88.8	81	11	8,050	8,900	0.9	45	20	41	65	0.6	10.0	0
13–19	87.6	84	11	9,550	6,450	1.5	65	21	43	64	0.7	0	0
20–26	85.9	82	10	9,000	4,390	2.1	34	20	41	40	1.0	5.0	0
July 27–Aug. 2	83.4	82	11	12,360	6,660	1.9	47	21	56	64	0.9	9.5	4.8
Aug. 3– 9	81.7	81	9	10,220	13,170	0.8	76	17	26	41	0.6	0	0
10–16	80.3	79	11	9,500	9,920	1.0	64	22	18	28	0.6	0	0
17–23	79.4	81	11	6,450	5,700	1.1	35	22	20	29	0.7	0	0
24–30	79.4	76	11	14,910	6,760	2.2	39	20	255	70	3.6	5.0	0
Aug. 31–Sept. 6	80.5	76	11	10,640	6,500	1.6	70	20	55	34	1.6	0	0
Sept. 7–13	82.7	73	6	9,580	11,210	0.9	55	17	103	37	2.8	0	0
14–20	86.1	71	9	23,440	17,130	1.4	81	22	89	99	1.0	4.5	0
21–27	87.4	69	11	15,920	11,730	1.4	87	22	85	106	0.8	0	0
Sept. 28–Oct. 4	84.4	68	8	22,500	16,750	1.3	129	19	140	163	0.9	5.3	0
Oct. 5–11	82.2	70	11	9,500	7,830	1.2	66	21	197	196	1.0	4.8	0
12–18	88.3	60	9	50,220	38,110	1.3	86	17	471	287	1.6	0	0
19–25	84.6	62	11	21,050	19,680	1.1	54	21	600	386	1.6	4.8	0
Oct. 26–Nov. 1	81.6	55	11	16,140	11,490	1.4	28	21	124	120	1.0	0	0
Nov. 2– 8	80.4	57	9	17,380	4,240	4.1	48	15	53	40	1.3	6.7	0
9–15	80.0	54	11	34,730	10,770	3.2	63	21	74	51	1.5	19.0	0
16–22	79.4	42	11	30,910	6,030	5.1	31	22	175	56	3.1	0	0
23–29	78.9	41	9	41,560	3,800	10.9	19	17	486	25	19.4	11.8	5.9
Nov. 30–Dec. 6	78.9	43	10	13,750	2,900	4.7	38	22	106	17	6.2	0	0
Dec. 7–13	78.8	40	9	11,560	2,010	5.8	31	22	91	18	5.1	9.0	0
14–20	77.0	33	10	6,930	680	10.2	21	22	76	4	19.0	0	0
21–27	74.9	34	6	2,530	130	19.4	4	14	66	3	22.0	0	0
Dec. 28–Jan. 3	75.9	34	9	33,140	3,690	9.0	11	17	363	104	3.5	17.7	0
Jan. 4–10	77.6	35	11	11,680	1,460	8.0	9	22	382	48	8.0	18.2	0
11–17	78.1	36	9	11,060	1,980	5.6	7	22	249	28	8.9	18.2	13.6
18–24	80.3	35	11	24,230	2,830	8.6	8	22	205	26	7.9	0	0
25–31	77.5	34	11	11,180	1,880	6.0	4	22	209	36	5.8	9.0	0
Feb. 1– 7	85.3	36	11	49,640	4,390	11.3	7	22	325	62	5.2	18.2	9.0
8–14	86.1	37	11	68,410	6,030	11.3	17	22	983	277	3.6	0	0
15–21	85.6	39	11	57,450	5,920	9.7	6	22	508	186	2.7	0	0
22–28	92.3	40	8	201,630	12,550	16.1	18	18	1,951	358	5.5	0	0
Mar. 1– 7	93.0	39	10	60,570	8,100	7.5	8	22	2,675	296	9.0	0	0
8–14	88.9	39	10	43,450	6,350	6.8	15	20	1,185	239	5.0	0	0
15–21	86.6	40	7	32,860	2,690	12.2	16	22	470	108	4.4	0	0
22–28	86.1	41	9	37,630	5,720	6.6	23	22	609	86	7.1	0	0
Mar. 29–April 4	86.7	43	11	26,950	3,580	7.6	17	22	739	69	10.7	0	0


COMPARISON OF 20°C AND 37°C BACTERIAL COUNTS ON RAW AND EFFLUENT WATERS
PLATE I
STAGE OF RIVER
FEET
BACTERIA PER C.C.
B.COLI PER C.C.
PER CENT
RAW WATER
B. COLI
RAW
EFFLUENT
PER CENT 10 cc. SAMPLES CONTAINING B. COLI
20°C
37°C
SPRING
SUMMER
FALL
WINTER

Plates 1 and 2 are plots of the data given in Table 1.

A study of Plate 1 shows, in general, that:

1. With a rise or fall in the river stage there is a corresponding rise or fall in the 20° and 37° C. counts in the raw water, though not always in the same proportion. This change also occurs with the effluent water though not to such a marked degree. In both the raw and effluent waters, the highest count of the year at either 20° or 37° C. occurs at the highest stage, the lowest at the lowest stage.

2. The 20° C. count on the raw and effluent waters is high during the spring and fall and winter whereas it is comparatively low during the summer. The 37° C. count in the raw water is high during the summer and fall and low during the winter and spring while the 37° C. count in the effluent water is high during the fall and winter and low during the spring and summer.

3. With the raw water there is no definite relation of any practical value between the coli count and the 20° or 37° C. count. During the winter and spring when there is considerable fluctuation in both the gelatine and agar counts there is but little fluctuation in the coli count.

During the summer and fall when the variation in count is not so great, there is a marked variation in the coli count.

There is no relation that shows any advantage of one count over the other in representing the sanitary quality of the water. The only relation existing, though of no practical value, is that the tests for B. coli in the raw water are higher during the summer and fall than during winter and spring, thus corresponding to 37° C counts.

The colon content of the effluent water likewise shows no relation between coli and agar or coli and gelatine counts.

A study of Plate 2 shows that:

1. The ratio of the 20° to the 37° C. count is very low in both waters from the latter part of spring to the middle of fall, that is when the temperature of the water is high. On the other hand, the ratio is very high from the middle of fall to the latter part of spring, *i. e.* when the temperature of the water is low.

2. During summer and early fall the ratio approaches unity, the 20° C. count frequently being less than the count at 37° C. The lowest ratio occurs during the period of highest temperature.

3. From the middle of fall to late spring the average ratio is unusually high, being highest at the period of lowest temperature.

In the quantitative bacterial examination of any water the total number of bacteria in the sample is the object sought. There is, unfortunately, no method known by which we can obtain a quantitative estimation of all living bacteria.

We have at our disposal the gelatine and agar counts. The usefulness of any method should, among other things, be judged by the value of the results obtained therewith. We would prefer a method which would give us the total count and at the same time serve as an index of the sanitary quality

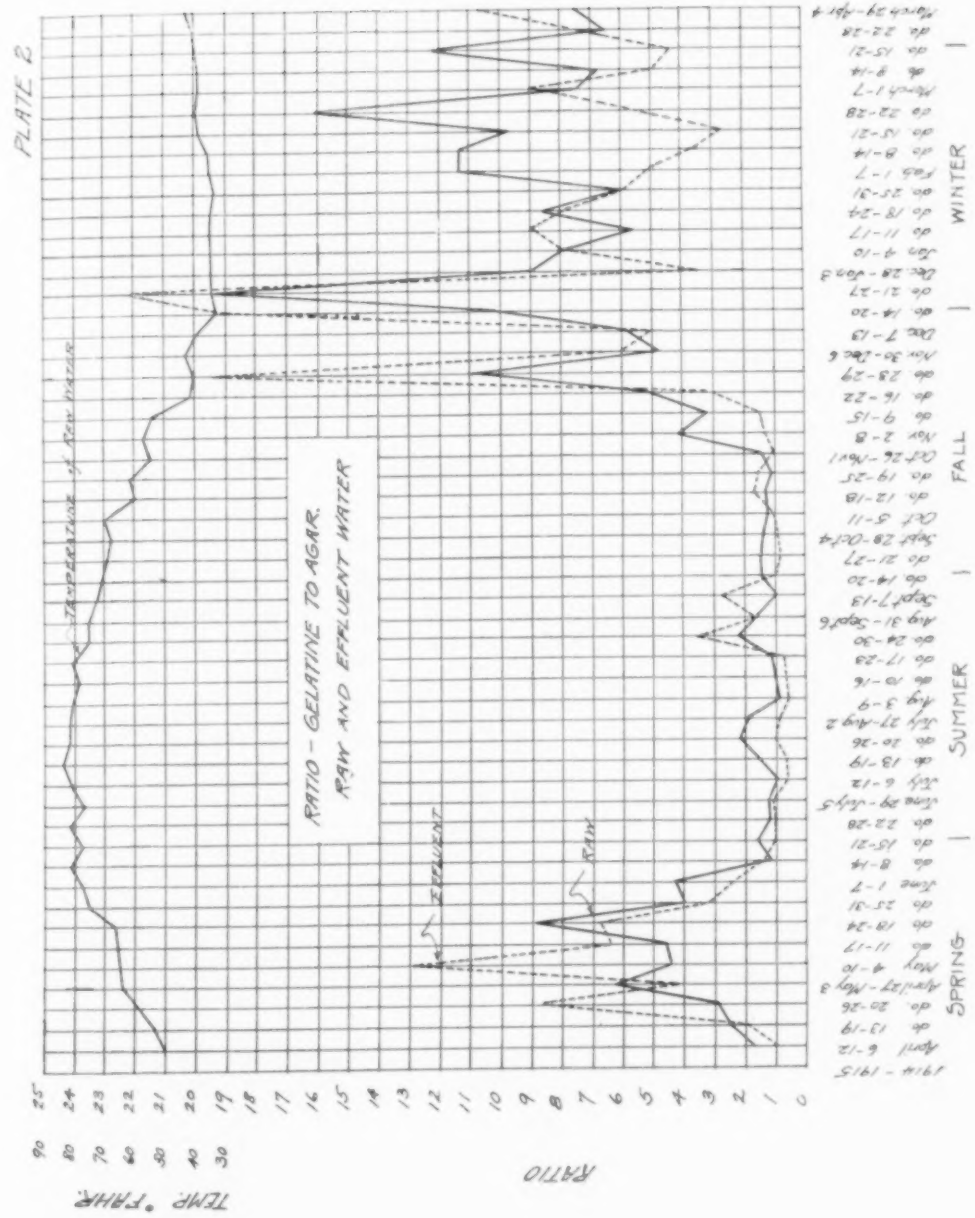


PLATE 2
RATIO - GELATINE TO AGAR.
RAW AND EFFLUENT WATER
EFFLUENT
RAW
TEMPERATURE OF RAW WATER
TEMP °FAHR.
RATIO
SPRING
SUMMER
FALL
WINTER

of the water. In this respect neither gelatine or agar will answer the purpose.

Gelatine vs. Agar.

Gelatine is more easily prepared in a shorter time than agar. The character of the fresh beef used in the preparation of both media determines to a great extent the clearness of the product. It has been our experience that with equal care in preparation, gelatine always yields better results. For use in plating gelatine also has some advantages. Agar must be cooled to a temperature slightly above that of its solidifying point. If the medium is too hot some of the bacteria may be killed, if too cold the surface of the plate on setting will have a rugged appearance which will make counting more difficult. As gelatine is slow in setting and has a much lower solidifying point it can be handled with greater ease and with less likelihood of killing the organisms.

Colonies of bacteria, in general, appear more distinct on gelatine than on agar. The gelatine count is more reliable than the agar for the number of plates lost by liquefaction of the gelatine is but a very small percentage of those lost by spreaders on agar.

One of the higher forms of bacteria (Thiothrix tenuis) is particularly troublesome in our local water at certain times of the year. Innumerable cases have occurred where a sample plated on agar in one and one-tenth cubic centimeter quantities, has yielded one spreader on the one cubic centimeter plate and no colonies on the one tenth. Frequently both plates have been spoiled by spreaders. Porous covers are used on all of our agar plates.

It is true that agar will yield a count in 24 hours but since it requires at least 48 hours for the qualitative examination of any sample it does not appear that the 48-hour count for gelatine is a serious objection especially when the sample is being subjected to a thorough examination.

As previously stated neither media is capable of indicating satisfactorily, the sanitary condition of the water. Gelatine gives a higher count than agar, shows a wider range of fluctuation and consequently is a better indicator of any change in the working conditions.

We are of the opinion that it is wise to use a 20° C. and 37° C. count at all water purification plants, for under certain conditions either or both counts may be advantageous.

Qualitative Analysis.

It appears that at the present time there is no universally adopted standard for the qualitative bacteriological analysis of water. The Standard Methods of Water Analysis of the American Public Health Association (1912) recommends the use of lactose peptone bile as the primary medium, whereas, recently, the Commission on Standards for Common Carriers in Interstate Commerce specifies that lactose broth should be used. As to secondary media both recommend either litmus lactose agar or Endo's Medium.

That the methods of the examination of water as supplied to cities and

towns and that supplied to railroad trains should be identical insofar as the primary medium is concerned seems essential. We cannot hope to get comparative results with other workers on the same water if the same primary medium is not used. This has been our experience and has yielded our city no small expense and an unlimited amount of unwarranted harmful advertising.

We have had several years of experience in the use of lactose peptone bile as the primary medium on waters of various degrees of pollution. We wish to present in the following lines our results for the fiscal year 1914–1915.

Source of Samples.

Up to about May of this year our system of purification has been one of sedimentation and coagulation with disinfection as final treatment. The raw water pumped from the Mississippi River is treated with lime and iron sulphate, flows by gravity through a series of sedimentation basins and thence after treatment with chlorine to distribution reservoirs from which the water is pumped into the mains.

Samples for examination are collected twice each day except Saturday afternoons, Sundays and a few holidays. Bacteriological analyses are made of the raw water, water from settling basins, from the distribution reservoirs and from the city taps.

Confirmatory colon determinations are made on all save river samples, presumptive tests on bile and Endo's medium being sufficient for the raw water.

From April 1914 to April 1915 there were analyzed:

1,462 samples from the settling basins,

1,081 samples from the distribution reservoirs,

1,320 samples from the city taps.

The yearly average count on agar was 183 for the water from the settling basins, 93 for the water from the distribution reservoirs and 86 for the water from the city taps.

Method of Examination.

Our policy in regard to the method of qualitative examination has been to strictly adhere to the Standard Methods of 1912. All media is made according to the methods specified.

The routine of qualitative analysis is carried out as follows; One ten and two one cubic centimeter quantities from each sample are inoculated into lactose peptone bile. For the ten cubic centimeter quantities straight 9″ x 1″ test tubes are used, whereas for the one cubic centimeter quantities glass-capped Brown fermentation tubes of about twenty cubic centimeters capacity in the closed arm are used.

These inoculated tubes, after 24 and 48 hours' incubation at 37° C, are examined for gas formation. The gas production in the Brown tube is recorded as the per cent. of the closed arm occupied by the gas. In the straight tubes formation of gas is noted as being a trace (tr.) or plus (+), the former denoting slight fermentation, the latter a vigorous evolution of gas.

If no gas is produced in the bile within 48 hours the result is recorded

as negative. If gas is formed in any tube at the end of the 24- or 48-hour period, a streak is made with a platinum loop previously dipped into the tube showing gas, onto the surface of a solidified plate of Endo's medium. By cutting the solidified Endo's medium on the plate into quandrants, four different transfers can be made on the same plate thereby saving time and media. If the platinum loop is made small enough isolated colonies will always be found at the end of the streak.

The "Endo" plates after inoculation are incubated for 24 hours at 37° C. They are then examined for the presence of colon colonies.

Organisms other than those of the colon group grow very readily in lactose peptone bile as well as on the surface of Endo's medium inoculated therefrom. Furthermore there is an organism (B. aërogenes capsulatus of Welch) with which we have very frequently met that will ferment the sugar in lactose peptone bile yet will not grow on the surface or in the depths of an "Endo" plate or of any other medium incubated aërobically. This anaërobic organism will later be referred to.

Realizing that the fishing of a single characteristic colony from any medium and basing the final result on its identification is a practice to be followed with precaution, we proceeded to examine in an experimental way a number of colonies of bacteria of various descriptions that were found on our water supply and that developed on Endo's medium after having been passed through bile.

Assuming that the chance of getting the typhoid organism on the Endo plate was nil it was only necessary to transfer colonies from Endo's medium to lactose broth, for every one will concede that organisms to be members of the colon group must ferment and produce gas in lactose broth. If no gas was formed in 48 hours in the inoculated broth tube, the colony was regarded as not containing members of the colon group. If gas was formed, the broth was examined for gram negative bacilli. If these were found further inoculation into gelatine was made. After four days the gelatine stab was examined for liquefaction.

If the organism picked from the Endo plate fermented lactose with gas formation was a gram negative bacillus and did not liquefy gelatine in four days, that organism was conceded to be a member of the colon group. In almost every case in the preceding experiments when the organism fermented and produced gas in lactose broth, it was gram negative and did not liquefy gelatine in four days.

A total of 301 colonies were examined as described above. It is almost impossible to enumerate in detail minute differences as occur in the appearance of surface colonies, therefore in this work the colonies were divided into three groups, namely red, pink and very light pink. Further differences noted and results obtained will be found in Table 2.

A study of this table suggests that there are three types of colonies that should be sought for in the examination of Endo plates inoculated from

TABLE 2.

APPEARANCE OF VARIOUS COLONIES DEVELOPING ON ENDO'S MEDIUM.

Color of colony.													
Red.								Pink.		Very light pink.			
Deep red. Metallic lustre.				Tiny intensely red capitate colony. Usually tough.		Red or deep pink with red core.		Convex or pulvinate. No red core.		Colonies less than 2 mm. diam.		Capitate colony 2 mm. or more in diam. Usually with gas bubble.	
Flat colony.		Convex or pulvinate colony.											
Number of observations.	Times coli confirmed.	Number of observations.	Times coli confirmed.	Number of observations.	Times coli confirmed.	Number of observations.	Times coli confirmed.	Number of observations.	Times coli confirmed.	Number of observations.	Times coli confirmed.	Number of observations.	Times coli confirmed.
9	0	17	15	27	0	36	28	115	0	90	0	7	6

lactose peptone bile, namely the convex or pulvinate deep red metallic lustrous colonies, the red or deep pink colonies with red core and the very light pink capitate colonies with gas bubble 2 mm. or more in diameter.

Having thus obtained a description of colonies that would generally prove to be of the colon group, we had a basis upon which to judge the type of colony to pick from the Endo plates.

Continuing the description of our routine method of analysis—the colonies developing on the Endo plates having the appearance of the above types were gram stained, inoculated into lactose broth and into gelatine as stab.

Thus we regard as confirmatory tests for B. coli: the fermentation with gas production of lactose peptone bile inoculated from the sample to be tested, the growth of typical colonies on the surface of Endo's medium inoculated as smear from bile, the fact that the typical colonies are gram negative bacilli and that they will not liquefy gelatine in four days and will produce gas in lactose broth in two days.

Results.

The striking feature of the results of the bile tests on our water is the enormous number of cases in which tubes showing gas yielded negative colon tests. (See Table 3.) Very frequently no growth whatever developed on the Endo plates inoculated as a smear from bile tubes showing gas. Unfortunately this feature was not noted until its occurrence assumed such proportion as to be annoying. It was then that a further study revealed that the organism B. aërogenes capsulatus of Welch was causing the trouble. It was found that this organism could be

TABLE 3.

SHOWING THE RELATION BETWEEN GAS FORMATION IN LACTOSE PEPTONE BILE AND THE PRESENCE OF B. COLI IN WATERS OF DIFFERENT DEGREES OF POLLUTION.

	Ten cc. tests.								One cc. test.																			
	Degree of gas formation.								Amount of gas formation—per cent. of closed arm.																			
	24 hour transfer.				48 hour transfer.				24 hour transfer.								48 hour transfer.											
	Trace		Plus		Trace		Plus		Tr.-25		26–50		51–75		76–100		Tr.-25		26–50		51–75		76–100		Total No. of samples gasing in lact. pept. bile.	Per cent. B. coli.	Total from all sources gasing in lact. pept. bile.	Per cent. B. coli.
Source of samples.	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli	No. of observations	% B. coli				
Settling basins	48	35	290	61	19	21	96	26	188	31	65	54	46	39	56	27	94	13	28	57	25	48	11	55	966	41		
Distribution reservoirs. .	119	7	281	18	79	4	138	12	98	5	26	15	17	29	17	0	40	3	13	15	8	13	8	25	844	12	2873	19
Consumer's tap	183	4	242	8	139	4	206	5	109	6	29	7	25	0	27	0	83	0	12	0	4	0	4	0	163	5		

obtained in pure culture from bile by successive daily transfers to sterile bile. The organism was frequently lost at first, because only a loop of the inoculated bile was used in making the transfer. Later 1 cubic centimeter quantities were transferred and always carried the culture along. Failure to transfer for three or four days resulted in the loss of the culture. Gas was also produced in lactose and saccharose broths when 1 cubic centimeter quantities were transferred to them. But slight gas formation was obtained in mannite and dulcite broths.

Litmus milk inoculated with the organism in pure or mixed culture, heated at 80° C. for ten minutes and incubated anaërobically for 48 hours at 37° C. showed stormy fermentation with the discharge of color, coagulation and the peptonization of the curd.

A freshly boiled tube of nutrient agar inoculated while hot with a loop full of the bile culture and incubated for 24 hours at 37° C. showed violent gas formation in the depth with a breaking up of the medium.

From a study of Table 3, we note that of 2,873 cases of gas production in lactose peptone bile only 542 or about 19 per cent. yielded confirmatory B. coli. This clearly shows that gas production in lactose peptone bile does not necessarily indicate the presence of a member of the colon group.

Judging pollution by the number of 37° C. bacteria growing on agar in 24 hours, we find that in the case of the settling basins (unchlorinated water, with an average count of 183 per cc.) there were 966 cases of gas formation in bile with 395 cases or about 41 per cent. yielding positive

tests for B. coli. In the distribution reservoirs (after chlorination, count 93 per cc.) there were 844 cases of gas formation with 97 cases or about 12 per cent. confirmatory B. coli, while in the water from the taps (average count 86 per cc.) there were 1,063 cases of fermentation in bile with only 50 cases or about 5 per cent. positive tests for B. coli.

From these figures it would seem natural to conclude that the bile test is a better index of the presence of B. coli the more polluted the water. In other words gas production in bile is less indicative of pollution, the purer the water tested.

With the 10 cc. quantities of water it would seem that a vigorous production of gas in 24 hours yielded positive tests for B. coli in a greater per cent. of cases from all sources than in the cases in which gas was not noted previous to the 48-hour period. Likewise with the 1 cc. quantities, we note, in general, that when the gas production was from 25 to 75 per cent. of the closed arm within 24 hours, a greater per cent. of positive tests were obtained than under any other condition.

A review of the available literature on the subject at hand shows varying results by different workers using lactose broth on the same class of water.

In the examination of about 1,000 samples of drinking water from railroad trains, R. H. Creel* obtained 454 samples in which 15 cc. produced gas in lactose broth. Of these, only 96 samples or about 21 per cent. proved to be B. coli.

On the other hand Edward Bartow† in the examination of drinking water on railway trains using the method adopted by the Treasury Department for drinking water on trains, obtained from 67 samples of water, 109 positive tests for gas formation in lactose broth. Of these, 91 tests or about 83 per cent. were shown to be B. coli.

* Hygienic Laboratory Bulletin No. 100, pp. 43-57.

† *Journal of the American Water Works Association*, Volume 2, No. 1.

REPORT OF THE COMMITTEE ON COLD STORAGE.

Presented to the American Public Health Association, Rochester, N. Y., September 7, 1915.

THE European conflict has added many burdens and responsibilities to the neutral nations on this side of the Atlantic. The whole complexion of business has already been materially changed. What opportunities and responsibilities may be ours as the war progresses or at its close, are difficult to predict, but it seems certain that they will be numerous and of a serious character. To a very large extent the belligerents are now looking to us for food and as the fighting continues we must more and more supply the materials for sustaining life. When peace is concluded and the freedom of entry into all ports for all products is again possible, it would appear probable that the demands upon us for foodstuffs would be for a time even greater than while the present conditions prevail. All of these more or less trite but obvious statements lead us to the point that there must be a greater conservation of our food resources. These resources will be severely taxed, and in order that we may satisfactorily discharge the obligations thus thrust upon us there must be a cutting out of all unnecessary

waste. This means that there must be a better handling and storing of the perishable food. To a very large extent the prompt and proper use of cold storage must play the important part in such a conservation movement.

For this and other reasons your committee has been impressed with the importance of encouraging, or promulgating if possible, propoganda for more and better storage facilities, and for greater use of the facilities now at hand.

During the year since the committee's third report was read to this Association at Jacksonville, eight or more states have introduced the so-called Uniform Cold Storage bill in their legislatures, and in a majority of these states it was passed and has become law. Notably in Pennsylvania it was defeated. In Congress the MacKellar bill never progressed beyond the committee hearing stage. This bill, in the judgment of your committee, laid entirely too much emphasis on the length of time which various food products may remain in cold storage and was not intended to encourage a more liberal use of cold storage to the end that a greater conservation of foodstuffs might be secured.

Such scientific investigations as have been made during the year have only tended to confirm the stand taken in your committee's second report (1913) in which it said:

"The committee believes that in all this (cold storage) legislation too much attention is being paid to the question of the length of time which various food products may remain in cold storage. The important point from a public health standpoint, as well as an economic one, is,—are the foods wholesome when placed in cold storage and are they in like condition when removed. Such scientific investigation as has thus far been made is not sufficient to say that any given food will remain good in cold storage for a given number of months and beyond that will be unfit for food. Nor do these investigations support such time limitation legislation. The two important points which this committee would urge with all emphasis are: First: that foodstuffs be in proper condition when placed in cold storage; and second, that foodstuffs not intended for immediate consumption be placed in cold storage at the earliest possible moment."

Since the above was written Dr. Pennington of the United States Department of Agriculture has demonstrated the importance of these two points in the story of "The egg and poultry demonstration car work in reducing our 850,000,000 waste in eggs." In this connection Dr. Pennington says: "The chilling of eggs is almost the beginning and end of keeping New York and other great cities supplied. Heat is the great enemy, for once a good egg has stood for any time at a temperature of over 68° F. it begins to incubate, if it is a fertile egg, or to spoil, if it is an infertile egg." Dr. Pennington estimates the value of the eggs of commerce to be $750,000,000 annually. The spoilage is therefore approximately 7 per cent. No reliable figures are known by your committee on the yearly loss from improper handling of other perishable food products. The total must be enormous. Can nothing be done to stop this loss of valuable food? Your committee has been giving this question serious consideration and now believes the time is ripe to undertake some educational work that will have for its object the breaking down of unwarranted prejudice against cold stored foods; the economic importance of the use of cold storage in the conservation of the food resources; and the importance from a public health standpoint of a sufficient wholesome supply of foods. The committee is without funds to carry on any work and it realizes that the Association is in no position to finance an educational campaign. The committee therefore proposes to inaugurate, with the consent and approval of the Association, a campaign financed by contributions from the outside. The rough outline of this campaign is here described.

First, it is proposed to interest one or more of the popular magazines to accept and publish one or more articles written in popular style which shall describe cold storage, its importance in the conservation of food, its control, and its indispensability in the modern scheme of food distribution. These articles would have the effect, it is hoped, of breaking down some of the unwarranted prejudice which the housewife and the average consumer now hold toward cold storage foods.

Second, it is proposed to publish in the farm, small town, and other periodicals circulating in rural communities, articles giving such information as is available about the loss in the food supply due to improper handling, particularly to

carelessness or indifference to the necessity of prompt cooling of perishable foods not intended for immediate consumption. This series will be intended to instruct the farmer that primarily from a public health standpoint, and secondarily from an economical standpoint, foods should be kept wholesome by the prompt use of cold storage, and where that is not readily available of providing it or some means of chilling or precooling.

Thirdly, it is proposed to have prepared a number of moving picture films which will tell in some interesting and popular way the story of cold storage and its benefits to the public. This will be illustrated by telling the story with pictures of some particular food industries which are dependent on cold storage for their very being, such, for instance, as the egg industry, the fish industry and the fruit industry.

Some progress has been made toward the working out of the details essential to this campaign. Through the suggestion and aid of Dr. Pennington much valuable material has become available for the articles both for the popular and agricultural periodicals. Also through the assistance of Dr. Pennington and the chairman of the Publicity Committee of this Association, Mr. Waldo, steps have already been taken to interest certain periodicals to print such articles as may be presented. For this branch of our program it does not seem likely any funds will be necessary.

The making of a moving picture film is a more ambitious project and one that cannot be undertaken without considerable expense. The preparation of a film to illustrate the egg industry has first been taken up because it is firstly one of the largest of the food industries; secondly, because it is one of the few about which we have a fairly accurate information, as to the extent of the annual loss; thirdly, because eggs are used in practically every household, and fourthly, because it is believed possible in illustrating it that an interesting film can be developed.

Fearing that we might be looking at this with prejudiced eyes, your committee has approached men in the egg industry, explained to them its program, and asked them frankly to tell it if in their opinion what it is planning is worth while; also whether they thought their industry could be worked up into an interesting film; and lastly if they would be willing to contribute toward the expenses. So far as your committee has gone it has met with an affirmative to all its queries from all those approached. It has been invited by the Committee on Publicity to present its plans to their coming convention of the National poultry, Butter and Eggs Association. Your committee awaits the approval of this convention to its plans before it accepts the invitation. It has also in similar manner presented its plans to an officer of the Warehousemen's Association, and has also answered its queries affirmatively.

Your committee therefore believes it can best serve the cause of public health by seeking to bring about a more general use of cold storage, particularly the prompt cooling of perishable foods at the point of production; that this can best be accomplished by the educational program outlined herein; that being without funds it would not be improper to accept contributions from those interested in the industries affected; and that the effects of such a campaign would be to conserve a greater proportion of the food produced and with a tendency to increase the supplies of the higher qualities.

Your committee would therefore request that the Association give its formal approval to its proposed campaign.

Respectfully submitted,

PROF. W. T. SEDGWICK,
DR. H. E. BARNARD,
DR. PETER H. BRYCE,
F. D. BELL, *Chairman.*

Book Review.

Diseases of Occupation and Vocational Hygiene. *Edited by Dr. George M. Kober and Dr. William C. Hanson. Twenty-nine contributors. Pp. 918+ xxi. P. Blakiston's Son & Company, Philadelphia, 1916. $8.00 net.*

To those who have been attempting to teach industrial hygiene during the last few years, the need for satisfactory, up-to-date reference books on the subject has been only too obvious. A book which went far to meet requirements from this point of view was "The Modern Factory," by Dr. George M. Price. Especially suggestive was this volume in its discussion of the usually neglected problems of machine guarding, fire prevention, welfare work, etc.

Now, however, the ever increasing number of physicians and sanitarians interested in industrial problems are fortunate in having placed at their disposal an extremely comprehensive compilation, including contributions from a host of authoritative editors selected from a wide range of activities and interests. Among those contributing to this volume, edited by Doctor Kober and Doctor Hanson, are Dr. John B. Andrews, New York City; Dr. Alice Hamilton, Chicago; Dr. E. R. Hayhurst, Columbus; Dr. Frederick L. Hoffman, Newark; Dr. Frederick S. Lee, New York City; Dr. Owen R. Lovejoy, New York City; Sir Thomas Oliver, England; Dr. John W. Trask, Washington, D. C.; Prof. George C. Whipple, Cambridge, Mass., etc. These names illustrate the scope of interest on the part of the contributors, including as they do, the practising physician, the legislator, the statistician, the physiologist, the sanitarian, and the sociologist.

In a foreword, the editors state that their aim "has been the presentation of the basic data concerning the diseases of occupation in such a way as to render them available not only to physicians, but also to employers, employees, efficiency experts, public health officials and legislators." To meet this objective, the book is divided into three parts.

Part One deals with specific and systemic diseases of occupation, and was devised particularly to furnish scientific information on the pathology, symptoms and treatment, for those interested in personal and medical phases of the problem.

Part Two approaches the problem from the occupational side, dealing with cause and prevention, and is of special interest to employers, employees, social workers, legislators, etc.

Part Three, and here the classification is perhaps not entirely clear or obvious, is intended to be of service to those who may be called upon to investigate the relation of the shop, the dispensary or the hospital to diseases of occupation. Much space is here devoted to statistical and legislative problems.

As is to be expected, the volume is especially complete in its discussion of trade poisons, considering them first from the point of view of the toxæmia itself and then making an extremely useful and somewhat comparative approach from the point of view of the occupation and the process. The special poisons are discussed by experts whose experience has furnished them with intensive knowledge of their particular field, whether it be carbon bisulphide poisoning, lead poisoning, the relation of dust to pulmonary disease, fatigue and industrial disease, etc.

In a volume as complete in many respects as is this book, some readers might perhaps like to see more attention given to the specific methods of accident prevention in industry. The volume contains many helpful illustrations, but could, perhaps, have been supplemented to advantage in this regard.

In addition, while the extremely important subject of personal hygiene is by no means neglected, one might wish for a more clean-cut and more prominently featured discussion of this subject. It is all there, but somewhat buried, and has to be searched for.

On the whole, however, the book should prove extremely useful to all interested in the subject, as the physician, the teacher, the sanitarian, the factory owner, or legislator. The point of view as regards certain controversial subjects, such as control of infectious disease, ventilation, etc., seems to be modern. The social aspect of industrial problems is not entirely neglected, for many of the contributors bring special experience from the social and economic fields. It might be mentioned, incidentally, that a brief yet interesting historical review of hygienic work in industry, will be found in the prefatory note.

D. B. Armstrong, M. D.

Health Department Reports and Notes.

REPORTS.

Cincinnati, Ohio.

The American Public Health Association this month is to meet in a city whose health record, as reported in the 1915 annual report of the Board of Health, is one of exceptional merit. The city of Cincinnati "through the cumulative effect of five years of intensive work" announces the breaking of all previous records along several lines, and the adoption of certain methods of procedure in complete accordance with modern theory and practice of public health.

The general death-rate has been reduced to 15.63 per 1,000 population, the lowest in the city's history; the tuberculosis death-rate reached the lowest point in many years, being 2.20 per 1,000 population; the infant mortality rate fell to 78; the deaths due to gastro-intestinal diseases in children under two fell to 175, which is only 46 per cent. of the deaths from this cause in 1910.

Upon examining these several excellent results, it is found in the case of the tuberculosis death-rate reduction, that the decrease is real and is not due, as is often the case, to possible errors in filling out death certificates. For instance, the tuberculosis death-rate diminished steadily from 2.81 in 1910 to 2.20 in 1915; furthermore, the reduction in "combined death-rate due to all respiratory diseases and tuberculosis" also decreased from 5.19 in 1910 to 3.99 in 1915. Thus the Board of Health, since assuming control of this department, can demonstrate a reduction of over 21 per cent. in the city's tuberculosis death-rate, and over 23 per cent. in its combined death-rate due to all respiratory diseases.

The reduction in infant mortality from all causes and from diarrhea and enteritis in children under two is attributed directly to the food inspection, particularly to efficient milk inspection. This is effectively shown by the two five year periods since 1906. The first period, in which there was no milk inspection, showed a varied infant mortality rate from 151 to 124; the second period, 1911 to 1915 (milk inspection was begun in 1911) varied from 103 to 78.

This substitution of a pure for an impure milk supply is considered also as a potent factor in the decrease of the general death-rate, even more so than was accomplished by water purification. Thus the average yearly decline following water filtration (three year period) was 2.03. The average yearly decline following efficient milk control was 1.15 lower than had been accomplished by water purification. As a consequence of this phenomenon, comparable with the Mills-Reincke phenomenon, Doctor Landis, chief health officer, has predicated the following hypothesis: "The reduction in the general death-rate of a municipality brought about by the purification of its milk supply, is practically the same as that caused by its change from a polluted to a pure water supply."

With the exception of an outbreak of measles, Cincinnati suffered from no epidemics, and the control of communicable diseases, under the able supervision of the chief medical inspector, Dr. Wm. H. Peters, seems most efficient. It is interesting to note the new quarantine procedure adopted by this city last December. As a consequence, the quarantine period and restrictions of those suffering from diphtheria, measles, whooping-cough, and mumps, or those in contact with them, has been lightened. In this way the unnecessary loss of time from school for the children has been abolished.

From the report of the medical relief of the poor, it is obvious that Cincinnati has maintained vigorous activity in this field. The work of the district physicians, the anti-tuberculosis league, and the infant welfare department deserve the sincere appreciation of the city. It is well to note that the health department is working in complete harmony with the charitable organizations. Such coöperation tends to minimize the abuse of charity.

Much attention has been paid to school hygiene, and the results from the sanitary inspection of school buildings and conditions of study, medical and dental inspection and treatment of school children, attention to children of

the pre-school age, and the education and instruction of children in personal hygiene are highly satisfactory.

Among the recommendations for the coming year, Doctor Landis advocates an extensive increase in his staff, a well deserved increase in salaries, the substitution of terminal disinfection with gaseous germicides by mechanical cleansing with liquid germicides, and the appropriation of the full budget requested. We hope that the people of this city will realize the full importance of this work being done and show their appreciation of the ability and unceasing energy of their health department, which has made this excellent report possible, by acceding to its recommendations.

NOTES.

Scoring the Sanitary Condition of Farms.—The Division of Sanitary Engineering of the West Virginia State Department of Health under the direction of the Chief Engineer, Mr. Mayo Tolman, is working on a score card for rating the sanitary conditions of farms. Perfect sanitation is represented by 100 points which are divided among all factors that tend to sanitary perfection as the water supply, disposal of wastes, etc. These points are subdivided among such factors as location of the well, its construction, the location of the privy, its type and construction, disposal of sink wastes, disposal of garbage, presence of screens on the house, handling of manure at the barn and so on. In order to create an interest in better farm sanitation, prizes are to be given each year at the "County Fairs" to the two farms in each county that show the greatest improvement in sanitation. One prize will be awarded to the farm for the highest total score, and the other to the one that shows the greatest gain in points during the year.

Those farmers who wish to enter the contest are required to hand in their names to the Health Department by October 1st, when the farm will be visited and rated by a representative of the Division of Sanitary Engineering. A second visit will be made to each farm the following June, and a new rating given. A comparison of the two scores thus obtained will determine the winners of the prizes.

The Prevention and Relief of Heart Disease.—In New York City, at the present time, over 10,000 deaths are reported annually as due to organic heart diseases, and in 1912, over 86,000 deaths from chronic heart disease occurred in the United States Registration Area. The apparent indifferenece of health departments in the administrative control of this problem has been no doubt due to the fact that the deaths reported are in the higher age groups. The New York City Health Department believes, however, that this age grouping is misleading, "for it gives no true picture of the age distribution of heart disease in the community," and that a much better picture can be gained by noting the age incidence of cases of heart disease observed in hospitals. Such a study shows a very large proportion of cases in all the age groups, commencing with as early as 10 years of age. The following table is cited, the 1,300 cases being taken from the report of a hospital in Glasgow:

Organic Heart Disease Hospital Cases Arranged by Age.

Under 10	20	cases
10–20	221	,,
20–30	264	,,
30–40	274	,,
40–50	257	,,
50–60	186	,,
Over 60	124	,,
Total	1,346	,,

To quote the *Bulletin* in regard to the control of this problem, and to the formation of an organization with the relief and control of this problem as its object:

"The physical examinations conducted by the Bureau of Child Hygiene indicate that approximately 15,000 of the 800,000 public school children suffer from organic diseases of the heart. It is clear, therefore, that the enormous prevalence of heart diseases in the community constitutes a public health problem of the first magnitude. Recognition of these facts has lead to the organization in this city of an Association for the Prevention and Relief of Heart

Disease. In a report just made by the Association, the opinion is expressed that the prevention of heart disease depends largely upon a study of the causes of the condition. These causes may be grouped under the headings infectious diseases, intoxication and improper methods of living. Of these, the infectious diseases seem to offer the most immediate point of attack; and of the group of infectious diseases those resulting from the so-called rheumatic group seem to be the most vulnerable.

"The program of the Association for the Prevention and Relief of Heart Disease embraces the following:

"1. To gather pertinent data from many sources, and to arrange it for general use and practical application to the purposes set forth.

"2. The office of the Association to serve as a central cardiac information bureau.

"3. To help in coördinating the various efforts in this field—as made by Health Department, school examiners, cardiac classes, dispensaries, special investigators, Trade School for Cardiacs, etc.

"4. To organize facilities for cardiac convalescence, to provide larger opportunities in existing institutions, through assurance of better selections of patients, better treatment, etc. (Especially for youth.)

"5. To help to establish more cardiac classes in clinics in appropriate districts, and to extend and correlate their efforts.

"6. To study and develop occupations for cardiacs, in standard trades and situations, as well as in special lines as already begun. To take constructive interest in workman's compensation and like problems affecting cardiacs.

"7. To work constantly for the prevention of heart disease, through the power of accumulated information effectively presented, and the increasing application of recognized means (such as adequate facilities for throat and dental treatment, particularly for children).

"8. To encourage the setting up of branch (or like) associations elsewhere.

"Eight special cardiac classes having a uniform working plan for the division and classification of cases have already been established. Seven of these are in Manhattan and one in Brooklyn.

"This program gives promise of effective work in reducing the incidence of heart disease and so preventing much future preventable suffering and disability.

"The Department of Health welcomes the new Association and the aid which it will, undoubtedly, furnish in this important domain of preventive medicine."

✦

A Vaseline "Squirt Gun" Marker.—We are indebted to Mr. F. A. Mantel, Chemist and Bacteriologist of the Memphis Department of Health, for the following brief communication:

"In the course of the routine of Widal and Malarial examinations in this laboratory which entail of course the 'ringing' of many hollow ground slides, I devised the following 'squirt gun' which I find is a great time saver and makes a very neat ring.

"Besides ringing for 'Widals' or other hanging drop preparations, I find the device of much service in the staining of blood smears: Outline the good portion of smear to be examined with the fine line of vaseline from the squirt gun and drop the stain in the plot, thus marked out. The stain of course cannot run off the slide or from the smear or preparation to be stained.

"The 'gun' is made by fitting a glass rod in a short piece of glass tubing of any size bore which is drawn to a very fine point, to any desired size opening. By causing suction at the drawn out end, fill the tubing with vaseline or the like. Insert plunger and thus have an ever ready 'squirt gun'."

✦

Tuberculosis in California Indians.—Nearly 30 per cent. of all deaths of Indians in California are due to tuberculosis. Trachoma and tuberculosis are more prevalent among the people of this race than any other of the communicable diseases. North Fork, Madera County, is the center of population for hundreds of these people, and the Bureau of Tuberculosis of the California State Board of Health has urged the Department of the Interior to establish a sanatorium for the Indians of this district. The government has land near the school and a mission already established there, and pupils and teachers are most desirous that a dispensary and hospital be established.

Tuberculosis has wrought great havoc among these people. In fact, so great has been the prevalence of the disease among them that, con-

trary to general belief, they are quite willing to enter a hospital, when ill. They are said to be model patients, willing to follow instructions and to obey orders. They want to die near home, however, just as any of us do. Consequently, many an Indian has been transported from the county hospital, over many miles of rough mountain roads, to reach home before death might come. Many times they have died before arriving at their homes. The establishment of a government sanatorium and dispensary would provide a place near at home for treatment and care.—*Monthly Bulletin of the California State Department of Health.*

✠

The Family Physician and Typhoid Fever—As a new routine procedure in typhoid fever the following letter to physicians is now sent to physicians who report cases of that disease to the New York City Department of Health. A sufficient supply of vaccine for initial doses is also sent, to avoid delay in immunizing exposed persons

The letter also deals with the conditions under which removal of typhoid fever patients to hospitals may be necessary.

More care, it is felt, is needed in the termination of cases of typhoid fever. The patient should be informed as to the likelihood of his being at least a temporary carrier of infection, and instructed accordingly.

"Acknowledgment of your report of a case of typhoid fever at ——— has been made in the usual way. Laboratory confirmation of the diagnosis is very desirable. If a Widal test has not been made, please send a blood specimen for such test. If it has been made, please notify the Department of the result. In obscure cases, a fecal examination is often conclusive. The Department will make such examinations at your request.

"Immunization should be offered to and urged upon all members of the household who have not had the disease, if they are in any way exposed to contact with the patient. That there may be no delay, we are sending you a supply of anti-typhoid vaccine by mail. You may have an additional supply free by mail or at any Borough Office, or a Department physician will administer it for you at your request. Arrangements can be made with the Branch Office at ———, telephone ———, or the Central Office, telephone Franklin 6280.

"Save under very exceptional circumstances, home treatment of typhoid fever is distinctly hazardous. Enclosed is a typhoid circular. These 'Rules' are designedly expressed in as simple language as possible, but further exposition by the physician is none the less necessary. If no trained nurse is in charge of the case, a Department of Health nurse will be sent to note whether or not proper precautions are being observed, and give necessary instructions as to details.

"Unless the following conditions exist, it may be necessary for this Department to remove cases of typhoid fever, especially in crowded tenements, to a hospital:

1. The patient must be actually isolated, visitors excluded, stools and urine adequately disinfected, and all susceptibles immunized against the disease.
2. The attendant on the patient must have nothing to do with the family cooking, care of children, etc. (Statements on this point which are manifestly untrue must not be accepted.)
3. There must be a watercloset or privy for the exclusive use of the patient's family.
4. The family must be sufficiently intelligent and willing to carry out the rules of the Department of Health for the home care of typhoid fever.

"The recent ruling of the Board of Health regarding termination of typhoid fever cases by bacteriological examination of feces and urine is now in force. These specimens are not to be collected before the tenth day after the temperature becomes finally normal. A typhoid fever convalescent may not return to work except with the approval of the Department of Health, based on the result of laboratory examination. The specimens may be collected in the Diazo outfits furnished at culture stations. They must be fresh, and delivered at the laboratory within a very few hours after voiding. To insure this, until further notice, they will be called for, arrangements being made by the Department nurse. The patient should remain isolated until the result of the examination of the feces is known. Not a few typhoid convalescents are temporary carriers, and the number of recog-

nized chronic carriers is rapidly increasing. In examination of stools, little reliance is to be placed on a single negative result, the Widal at this time being regularly positive. Hence all precautions must be observed.

"Finally, the source of your patient's infection is of especial interest. If you have arrived at any conclusion on this point, or if you discover any facts bearing upon this aspect of the case, please notify us. When our own investigation is completed, we shall be very glad to compare notes with you."

School for Public Health Nurses.—The *Board of Health Bulletin* of the State of Wisconsin announces the establishment of a training school for public health nurses. This school has been organized by the Wisconsin Anti-Tuberculosis Association in coöperation with the Milwaukee Visiting Nurses Organization and the Milwaukee City Health Department, and according to this bulletin, it is the first training school for the education of nurses along this particular line of work organized in the country. Up to this time throughout this state it has been difficult to obtain the services of a sufficient number of especially trained and competent nurses for this work, particularly on account of the unusual demand for both rural and urban public health nurses. The public health nurse is the most valuable a health officer can have, and it is to be hoped that this new movement will meet with every success.

A Sick City.—The Division of Health of the City of Toledo, Ohio, was asked to comment in the Toledo *Weekly City Journal* on the health situation of that city. The following rather startling indictment and prophecy was the result:

"It is true that there is scarcely an activity of our city government that does not have more or less influence upon the health of the people. So long as the city is inadequately financed and there is provided insufficient funds for the various departments to do their work thoroughly, just so long will the death-rate be high in Toledo.

"The tremendous price that we are paying in health and life for economy is indicated in the following table, which is a comparative statement of sickness and death from certain of the better known reportable diseases during the first eight months of 1915 and 1916 each:

	Cases.		*Deaths.*	
	1915	1916	1915	1916
Typhoid fever	191	145	26	26
Diphtheria	145	211	18	25
Measles	527	4984	4	68
Scarlet fever	135	427	4	5
Whooping-cough	546	486	20	11
Smallpox	61	209	0	1
Poliomyelitis	1	84	1	17
Tuberculosis, all forms			245	283
Diarrhea, under 2 years of age			63	126
Lobar pneumonia			85	139

"We prophesy that this parsimony in the maintenance of the necessary functions of civic government and the lowered resistance of our people because of the undue prevalence of disease thus far this year will result during the coming winter, in the highest death-rate that Toledo has ever had.

"This calamity may be partly avoided by an immediate rehabilitation of all departments. Even so the damage is done and is just now reaching its climax. We will require years to overcome it with the best facilities that can be provided. Toledo is assuredly a sick city."

The Low Cost of Health.—We hear much of the high cost of living, but we overlook the fact that many of the best things of life can be had for nothing.

It costs nothing to stand up and walk and breathe properly.

Fresh air in the home is free.

No expense to taking a few simple exercises every morning.

It costs nothing to chew the food thoroughly.

It costs nothing to select the food best suited to the body.

It costs nothing to clean the teeth twice a day.

It costs no more to stop using patent medicines.

It costs no more to read good books than trashy literature.

It costs nothing to have a cheerful, happy disposition, and stop having grouches.

These things cost nothing, yet they will bring content and reduce the doctor bill to nothing a year.—*For You*, Ford Motor Co.

Public Health Notes.

Anopheles Infectivity Experiments.—The *United States Public Health Report* for September 1, 1916, contains an interesting account of the extensive experimental work carried on to determine the number of persons one mosquito can infect with malaria:

"The work here described was conducted in the course of malarial investigations under the charge of Surgeon R. H. von Ezdorf, United States Public Health Service, and the findings and the care of the cases had his supervision and confirmation.

"In an effort to ascertain the infectibility of *Anopheles punctipennis*, several volunteers were bitten successively by a series of three mosquitoes, which had been applied ten days or more previously to an uncomplicated case of benign tertian malaria.

"If it can be established that amalarial mosquito once infected remains so, it would appear an added contribution to our knowledge to at least approximate the extent of this infectivity. Is every bite an infective one, and how many persons in a community can be infected by the same mosquito? A partial solution of these problems is attempted in this series of experiments. Here fourteen cases of malarial fever resulted from the bites of infected mosquitoes. In eleven of these successful transmission resulted from mosquito biting which was purposely interrupted in order to induce the insects to bite as many persons as was practicable. Applying the mosquitoes so that one person after another was bitten in rapid succession (or at short intervals), it was indicated that in nine of these experiments successful conveyance of malaria resulted.

"The factors governing the power to convey infection are regarded as dependent upon:

"(a) The number of sporozoites in the salivary glands.

"(b) The number of sporozoites discharged at each feeding.

"(c) The viability and longevity of the sporozoites in the glands.

"The loss of power to convey infection in this species of *Anopheles* probably depends on the elimination of the sporozoites from the salivary glands through discharge or death of these organisms.

"In seventeen experiments in which human beings were employed to test the infectibility of *Anopheles punctipennis* with *Plasmodium vivax*, fourteen cases of malarial fever resulted. The sporozoites, in the mosquitoes used, developed ten to twenty-two days after the definitive hosts were given an opportunity to bite a patient harboring a scanty number of mature tertian gametocytes.

"In an attempt to infect several persons with a single specimen of *Anopheles punctipennis*, one mosquito proved to be the sole infective agent in one experiment and one proved to be the sole infective agent in three experiments. These two specimens, when applied to the same person, transmitted the infection in five cases, while one of them used with a third mosquito succeeded in infecting four persons.

"In these experiment alinoculations it was demonstrated that in nine instances in which two mosquitoes succeeded in transmitting malaria at least one of the pair was proved to be capable of causing the disease when used singly.

"It was demonstrated in eleven experiments that short exposure to bites was sufficient to cause successful transmission of the disease.

"In all of the successful inoculations only tertian infection was reproduced. *Plasmodium vivax* was demonstrated microscopically."

✠

"The Need of Uniform Health Regulations in the Southern States.—Dr. D. W. Jones puts forth a splendid plea for uniform health regulations in the *Southern Medicine* for September, 1916.

"A careful comparison," says Dr. Jones, "of the health regulations of the Southern States shows such a striking similarity that one is forced to ask why we cannot have a uniform set of rules and regulations. Why cannot the Southern Medical Association appoint a commission to draw up such a plan as would be acceptable to all the Southern States, at least in its basic features?

"Take, for illustration, the matter of inter-

state travel. The regulations in regard to spitting, cuspidors, sweeping, sleeping, the conduct of railroad authorities in the case of contagious diseases en route, reporting, detention, disposition of infected cars, disinfection, etc., should be the same in every state.

"All these matters are covered in a general way by the Federal regulations, but many of our states have additional regulations. Why not all have the same? We should have uniform regulations as to interstate quarantine, uniform restrictions as to travel, detention, certification of health; also as to domestic quarantine, length of time children should be kept at home after various contagious diseases, uniform penalties for false certificates, uniform rules for reporting contagious diseases, and penalties. We should have uniform regulations as to maritime quarantine, detention at ports, inspection, docking, unloading, disinfection of ships, examination of sea-faring men, and reporting sickness of such after going ashore. The Southern States should have an agreement as to reporting in good faith all contagious diseases, after a uniform plan, to the several state boards.

"These matters are necessarily under Federal control to a considerable extent, and the more we leave interstate traffic to the Federal government the better it will be in my opinion. But since the interstate and local regulations must necessarily intervene to some extent, it seems that we might have a commission composed of, say, one representative from each state and one from the United States Public Health Service. Care could be exercised in considering the relations between the state and Federal authorities, and some things could be left to individual states that have unique conditions. This commission could invite the railroads to send representatives to its conferences and thus guarantee their hearty co-operation with any regulations governing transportation. The general rules would of course have to be sent to the individual states for ratification by their state boards. But the fact that they had a representative in the conference would go a long way toward assuring their acceptance."

⚜

Motion Pictures and Eyestrain.—"Will frequent attendance at the movies affect my eyesight?" This is the question put and answered by Gordon L. Berry in the August *Bulletin of the Department of Health of the City of New York*.

"To that question, there are two answers: First—'Motion pictures with defects of photography, manufacture and projection apparent, may prove injurious to eyesight,' and second—'Eyestrain caused by viewing motion pictures may indicate a subnormal condition of the eyes which should demand immediate attention on the part of your physician.'

"There has never been an extensive study made of the subject, but occasional investigations by interested oculists, illuminating engineers, et al., have developed conclusions which time is proving logical, and which are coming to be generally accepted. Their studies have been in large part based on a few well-known principles relating to illumination and eyestrain, and proceeding on the theory that motion pictures *may* be a source of eyestrain, let us see what may be the causes, and the methods of prevention. The chief points involved are:

"1. The effect of glare from a poor screen as the result of improper radiation from the screen.

"2. The general surrounding illumination of the auditorium.

"3. The position from which the spectators view the pictures.

"4. More serious than any of the foregoing possible causes is the 'flicker' of the films.

"5. The effect of constant prolonged concentration.

"It is not the purpose," says the author, "to frighten the habitue of the popular picture houses, but rather to reassure him to the effect, that, if all conditions are as nearly ideal as it is possible for them to be, there is not much danger of serious fatigue resulting from a moderate attendance at the silent drama. If, under such suggested conditions, however, there are evidences of eye fatigue, such as headache, smarting or itching of the lids, sensitiveness to light, excessive flow of tears, or if circles of light seem to appear on the screen—one should lose no time in consulting an oculist. The trouble evidently is not with the pictures, but with the individual, and Nature is sounding her tocsin of alarm in time to make it possible for him to remedy the trouble if he will but give it attention. Indications of serious diseases of the eye,

like glaucoma, which will result in blindness, if neglected, may thus be recognized and treated in time."

The Rat and Infantile Paralysis.—An extremely interesting statement of the case against the rat in the spread of infantile paralysis appears in the *Boston Medical and Surgical Journal* of September 21, 1916, by Dr. Mark W. Richardson of Boston. Dr. Richardson presents his arguments in two ways:

"First, those arguments which militate against the transfer of infection by direct or indirect human contact, and, second, those which support the theory that the disease is transmitted by rats or other rodents, by insects on the rats or rodents, or by both in combination."

"If, now," he goes on to say, "we take the rat and its parasite, the flea, as the hypothetical agents in the transmission of infantile paralysis, how does this assumption fit the epidemiological facts?

"1. The rat has a world-wide distribution.

"2. It is found in habitations of all classes of the community, rich as well as poor.

"3. In the winter time the rat keeps largely to its hole, coming forth in the spring with the advent of warm weather and the growth of appropriate food.

"4. Although statistics are unavailable, it seems highly probable that rats are more common in the country, at least in proportion to the population, than they are in the city. In any event, it is not unreasonable to suppose that in ordinary country barns, out-houses, etc., the exposure to rat influence is much more marked than it is in the city where the houses are better built and where sewage and other sanitary provisions are much more complete. In any event, the children are constantly in the barns and numerous cats and dogs might convey infected fleas to the houses. Incidentally, the cats and dogs might become infected. This increased exposure to rat influence might, moreover, explain the higher percentage of adult infection in rural districts, noted by Frost.

"5. The great increase in poliomyelitis during the last twenty-five years has been explained as due to the great increase in facility of transportation all over the world, so that infinitely increased human contact has become possible. The same argument would apply, however, to the transfer of infected rats from one locality to another. Indeed such transfer in freight cars and ships carrying grain, cattle, pigs, etc., must be common. This brings us to another consideration.

"6. That the relation to the railroads of cases of infantile paralysis has been noticed by a number of observers. Nothing could be more probable than that children living near railroads should play in rat-infected freight cars. Infected rats, furthermore, if dropped from freight cars, would necessarily seek their food in the immediate neighborhood. A possible case in point was that of a young college student who contracted infantile paralysis during his summer occupation as a freight brakeman.

"7. In the study of the epidemiology of infantile paralysis, it has been a common observation that (a) the disease occurs in foci; (b) in general, the cases spread more or less radially from centres of infection, and (c) the intensity of infection rises in one neighborhood while it is decreasing in a focus in its immediate vicinity. Such a fact is hard to explain through human transmission, which should result in the irregular distribution of cases, but is perfectly consonant with a gradually spreading infection of rodents.

"8. It has been noted above that districts severely affected by infantile paralysis are rarely affected again for a considerable period of time and that the Swedish observers have attempted to explain this fact by the assumed occurrence of a far-reaching immunization of the general human population. I have already pointed out that such a theory would be tenable only if adults were markedly subject to the disease. I believe, however, that such a local geographical immunization might well be possible through extensive infection affecting primarily not the human, but the rodent population. With the immunization of the rats, the human epidemic must necessarily cease. Whether such an immunity exists and can be transferred from adult rodent to offspring must be determined by experiment.

"9. In the transfer of the infection from the rat to man, the agency of the flea is assumed, although the possible contamination of food by rodent excretions might well be considered. The

insect transfer might be simply mechanical or it might require a preliminary cycle of development of the virus in the flea. Furthermore, the possible rôle of cats, dogs, and other animals, or even human beings, as carriers of infected fleas, would be apparent. Moreover, in grossly unsanitary surroundings, the fleas might carry infection from one child to another directly.

"The foregoing theoretical considerations have been put forward as explaining better than any other hypothesis as yet submitted, the epidemiological facts as observed in infantile paralysis.

"The human contact theory cannot be made to fit these facts except by efforts so extraordinary that the value of the theory is thereby practically destroyed."

The Sewage Pollution of Streams.—"In every inhabited country," says Dr. W. H. Frost in the *United States Public Health Report* for September 15, 1916, "the surface waters almost inevitably become more or less polluted with human excreta, but gross pollution of large streams, such as is now frequently encountered, results only where people are congregated in cities, discharging their wastes directly into watercourses through sewers, and these conditions are of comparatively recent development. This is especially the case in the United States, where many of the large cities have sprung up within a few decades; but even in the more densely populated European countries conditions of stream pollution have become much more serious within the last fifty to one hundred years, with the development of sanitary sewerage.

"For the prevention of the nuisance resulting from gross sewage pollution various processes of sewage treatment have been devised. These processes differ widely in their details, but all have two principal objects—the removal of solids and more or less complete oxidation of organic matter.

"Experience has proven that these processes of sewage treatment with various combinations and modifications, are adequate for the prevention of the offensive nuisance resulting from excessive pollution of streams with raw sewage. The cost of such treatment, though considerable, is not prohibitive, and is being gradually reduced by further improvements in efficiency of methods.

"The diseases which may be and frequently are caused by drinking sewage-polluted water include typhoid fever, Asiatic cholera, dysentery, and various more or less well-defined forms of enteritis, as well as infections with animal parasites. Each of these diseases is caused by a specific organism and, with the exception of certain animal parasite infections, the diseases of this group are peculiar to man, not affecting the lower animals. The specific germs of these infections have apparently no other natural breeding place than the human body, and are found in nature only in the bodies and the excreta of infected persons.

"It is, therefore, accepted as one of the rudimentary requisites for conservation of the public health that public water supplies must be protected from such dangerous contamination.

"The difficulties of the situation are many. The cost of such sewage treatment as may be necessary materially to reduce the sewage pollution of large streams is the first difficulty. The community bearing an expenditure for sewage treatment to protect the water supplies of other communities does not itself receive the dividends from the investment in better protection of its own citizens' health; and for this reason such expenditures are likely to be opposed unless clearly demonstrated to be necessary. But obviously a dire necessity can be demonstrated in a specific instance only after conditions have already become so bad and continued so long as to have caused more or less extensive disaster; and this, of course, must not be permitted. The measures taken must be anticipatory and preventive, not remedial and delayed until after extensive injury has been done. They must therefore be in a sense arbitrary, sufficiently radical to maintain a wide margin of safety, and not so radical as to involve enormous expenditures without justification.

"The first requisite in the control of stream pollution to-day is, therefore, a closer and broader study of the conditions of pollution existing in the rivers of the country, of the fundamental factors that influence these conditions, and, above all, of their effects upon health. Without such studies there can be no accurate knowledge as to the necessity for remedial measures and no reliable estimate of the influence of proposed measures in protecting the

public health. In the meantime it is hardly to be expected that the public will be willing to invest enormous sums for the improvement of stream-pollution conditions without knowing what returns may be expected from their investment. It is not sufficient merely to state that there will be 'some' returns in the saving of life and health; it is necessary to prove the assertion and, if possible, to show the extent of the saving in definite terms. The development of a universal sentiment in favor of water-purification plants must be credited chiefly to the definite proof of their efficiency in saving health and life. Similar proof will win equal approval for any further measures that may be required."

*

Sanitary Survey of a Trial City Block.—"While labor organizations and other departments have paid special attention to factory conditions with regard to sanitation they have neglected to a very large degree office conditions." This statement indicates the very great sanitary value of the study recently made in New York under Dr. Marion B. McMillan and reported in the monthly *Bulletin of the Department of Health of the City of New York* for August, 1916. The sanitary survey included the "sanitary" condition, lighting, ventilation and social conditions of workers employed in the office buildings located between Broadway, Nassau, Cedar and Liberty Streets.

"The block, as a whole, is typical of those found in the financial district. It contains a building of the oldest type, a building of a slightly more modern type, a building of a still more modern type, and also a building in which has been attempted the most sanitary up-to-date installations possible. In these buildings divers industries are carried on, and in all of them similar conditions exist to which the office worker is subjected.

"The most important points which were to be considered in this survey were recorded on a specially made report card. These report cards included three forms: 1, An Office Block Record; 2, An Office Building Record; 3, An Office Suite Record.

"An extensive and minute survey was made regarding the light on this block. The tests were made with a Macbeth illuminometer. The readings were taken several times, in order to insure accuracy, and the machine was standardized daily before any readings were made in order to avoid any possible errors. The results of the use of this instrument were eminently satisfactory. The conclusions which were drawn from the numerous observations made may be stated as follows:

"Artificial light is used very generally for the purpose of illuminating the offices. This fact is not only true of offices located on the lower floors and inside of offices, but offices that are located on the uppermost floors. The percentage of employes on this block, using artificial light, was found to be 85.33 per cent., and that of those who were using natural light was only 14.67 per cent. When it is considered that the above figure of 85.33 per cent. represents the number of employes who are continuously subjected to artificial light, it would be well to stop and consider what the effect might be on a human being living continuously under such artificial conditions.

"What struck one most forcibly in the survey of this block was the fact that great attention had been paid to the aesthetic effects in lighting both the buildings and offices. Great skill had been shown, in many instances, in installing expensive electric fixtures for the purpose of display, but little or no attention had evidently been paid by the engineers regarding the physiological effects resulting from their installations.

"It may be stated, as a general conclusion, that the ventilation throughout this block is unsatisfactory for the reason that:

"1. The heights of the buildings surrounding and composing this block have a tendency to create strong currents of air, both in air-shafts and in streets adjoining the block. The individuals inhabiting these offices avoid opening the windows during cold weather on account of the drafts produced by so doing, as well as on account of the temperature. It is common to find, therefore, offices absolutely sealed from outside air.

"2. Inside openings, such as transoms, etc., exist only in a few instances, and where they do exist, are not in use.

"It might be advantageous to ventilate an office building through the hallways, the air being properly heated before being introduced

into the office. Where mechanical ventilators of an individual type, run by electricity, have been installed, the results have been extremely satisfactory, especially in those devices where the air is heated.

"It will be impossible to enforce a standard regarding ventilation until fresh air can be introduced in sufficient quantities and at a given temperature.

"At present, should the Department of Health enforce a standard, it should be one of quantity and temperature.

"Temperature: The average temperature of the buildings throughout the block was found to be from two to three degrees too high, taking as a limitation 70° F.

"Humidity The humidity in the office buildings of this block showed that a great lowering in relative humidity takes place under conditions of artificial heat. This amounts to from 62 to 66 per cent., when compared to the relative humidity of the atmosphere surrounding the buildings. The conclusions drawn from the relative humidity observations made show distinctly the fact that an enormous reduction in water vapor in the air takes place. The office worker is subjected to a temperature, as a rule, from 70° to 72° F., with a relative humidity of from 21° to 43°. When it is considered that the outside temperature, through the winter, ranges from 10° above zero to 54°, with an average, say, of about 40°, it will be seen that a person is subjected to change of 30° in temperature, and about 26° in humidity, the moment that he leaves the office and goes out into the street. There is no doubt that this rapid change of temperature and humidity is largely responsible for catarrhal conditions of the naso-pharynx. Excessively dry air has an irritating effect upon the mucous membrane of the nose and throat. If we add to this its high bacterial content, which is found when people are crowded together in an office, it is no wonder that morbidity rates are high in some of our office buildings."

Industrial Hygiene and Sanitation.

Health Conditions in the Cotton Mills.—It appears to have been necessary for the Massachusetts Child Labor Commission and State Board of Labor and Industries to secure the assistance of the United States Public Health Service in obtaining information concerning the physical condition of minors at work in the various cotton mills of the state.

The result of this investigation is a government publication in the form of a public health bulletin, "Influence of occupation on health during adolescence," and is a report of the physical examination of 679 minors under eighteen in the cotton mills of Massachusetts. The report is by Victor Safford, Assistant Surgeon, United States Public Health Service, and as far as it goes, is interesting but because of the comparatively small number of boys examined permits of no definite conclusions, a fact evidently recognized by the author of the report.

"The only serious menace to health in the cotton mills is really atmospheric," yet even in that Doctor Safford's report is far from alarming. Before the international congress on tuberculosis held at Washington in 1908, the census bureau prepared a report showing that of the total of 690 deaths due to pulmonary tuberculosis per 100,000 of population, the highest number was among the marble and stone cutters, and that deaths of mill and textile workers came thirty-fourth in the list of occupations. Doctor Safford's own investigation showed that including epidemic colds and various abnormalities which could not be attributed to mill conditions, 499 out of the 679 boys examined revealed no discoverable abnormality of the respiratory mucus membrane. "This alone," says Doctor Safford, "would seem to justify some doubt as to the harmfulness of ordinary cotton mill atmosphere to the human respiratory apparatus."

Doctor Safford states that, "So far as physical effects of usual cotton factory work in the State of Massachusetts on male minor employees are concerned the hazards in the industry practically are reduced to the possible effects on the minors of the atmospheric conditions of the mills, not merely on the healthy and vigorous but on those who may in some way or other be abnormal.

Such an investigation as this might have been

made of material value if it had but included inquiry as to the home conditions of those minors seen in the mills. It is probably fair to believe that a great number of employees seen by Doctor Safford come from parents who had also worked in cotton mills and in turn whose parents and grandparents had labored in the mills of this country and England. The influence of heredity and environment is strikingly shown in that class of boys examined by Doctor Safford and it is a fact that no investigation of this sort should be considered complete unless it considers, as well as the conditions under which the minor works in the mills, those equally important factors of home surroundings, environment and heredity influence.

⚜

Pennsylvania's Fatality Record.—Pennsylvania continues an unenviable record of fatalities in her industries from report received at the Department of Labor and Industries of that state. It appears that during the month of August 246 workmen were killed, the highest total of any month during 1916. The total killed and injured during the month was 23,817, a daily average of 882. It further appears that there were nearly as many fatalities in the industries of that state during the first six months of 1916 as during the whole of the year 1915. To be specific, 1,136 workers were killed from January 1 to July 1, while the total fatalities for 1915 were 1,263. All casualties, fatal and otherwise, numbered for the first six months 121,180, while for 1915 they totaled but 61,540.

While this sad showing may in part be due to the fact that a larger number of persons are now employed in Pennsylvania than ever before, it is nevertheless a significant commentary on the failure of "Safety First" measures when these are set aside in the rush for gain in boom times.

Other states than Pennsylvania have during the past year shown a marked increase in the number of fatal industrial accidents reported, an increase that can by no means be accounted for by the increase in persons employed. It is highly probable that until definite standards of safety work are adopted by the various states, standards not general but specific, for the various industries, an increasing number of accidents, fatal and otherwise, will be reported to those State Boards in whose hands the administration of preventive measures lies. It is not sufficient that this, that and the other manufacturing establishment may rely upon its own pleasure to diminish accidents within its own walls. It is not sufficient to rely upon the regulations or requirements of insurance companies covering liability risk. It is by no means sufficient to rely upon suggestions of self appointed counsels with enthusiasm far at variance with their experience. Here, if anywhere, lies an opportunity for the American Public Health Association, through their section on Industrial Hygiene, to establish safety standards through committees for the various industries, to see that the standards have the elements of common sense, and, most important of all, to suggest some way in which the standards may meet with proper enforcement by state authorities.

⚜

Health Insurance in Wisconsin.—The Wisconsin Federation of Labor, at its recent annual convention, voted to conduct a vigorous legislative campaign next winter, and the American Association for Labor Legislation is out with a model bill which it announces will be introduced into more than twenty state legislatures next January.

Briefly stated, the model bill of the association provides universal insurance against sickness for all manual workers and all others earning less than $100 a month. Benefits include medical treatment and medicines, as well as a cash compensation equal to two-thirds of wages during sickness, but not to exceed twenty-six weeks in any one year. There is also a burial benefit of $50. Contributions are to be paid in equal amounts by employers and employees, and the state will add one-fourth to the total as its share, and will supervise the funds which are to be mutually managed. Careful students of the subject declare this plan will result in a "Health First" movement equal in importance to the "Safety First" campaign which followed the enactment of workmen's compensation laws.

⚜

Health Conservation in Mining Industries.—The United States Bureau of Mines, Department of the Interior, which has in the past been mainly interested in the reduction of deaths by accidents among men connected with the mining industries, has broadened its scope to include the health of the men and has just issued a

report on health conservation at steel mills. This report, while especially prepared for the benefit of the men who toil in the great steel mills, contains advice of direct value to every one of the 30,000,000 workers in the United States and also to all employers of labor.

"The importance of the prevention of disease among workers can be realized from the fact that the average loss of time due to illness among approximately 30,000,000 workers in the United States is nine days a year," says Surgeon Watkins. "If medical attention be estimated at one dollar a day and earnings at two dollars a day this loss amounts to nearly $880,000,000 annually.

"The statement that a man whose health is below par has a working efficiency below par should need no explanation. Efficiency of the workman is a subject no operator can afford to ignore, for, after all, industrial efficiency depends on the man behind the machine. Aside then from its humanitarian aspect, the prevention of conditions productive of ill-health is a plain business proposition."

✽

Bonus for Ford Employees.—A bonus of $850,000 was distributed recently among the 1,399 foremen and department heads of the Ford Motor Car Company as their reward for service and results obtained throughout the year.

Each man who shares in this bonus will receive from $100 to $1,000 as a reward for his length of service, efficiency and usefulness to the company.

Of the 1,399 men who will share in this bonus, 231 are in the branch offices and factories, 100 in the main office and the remainder in the main shops.

✽

"Safety First" for Munition Mills.—To secure better conditions of safety in those plants engaged in the manufacture of munitions a conference was held in Philadelphia during September to standardize methods and reduce risks in the manufacture of explosives.

The code as proposed regulates the clothing that a workman in a munitions plant shall wear and oversees his habits. It provides that no man with the smell of intoxicating liquor on his breath shall be allowed to enter a munition factory. Men are not allowed to chew tobacco while on duty. No steel of any kind is allowed in their shoes or in their clothing. Match inspection twice a week at irregular intervals is called for to prevent the smuggling of matches into the plants. Among other suggestions for safety the code asks that reflected light be sent into the room from an outside source when work must be done at night.

✽

Self-Preservation.—Self-preservation is the first law of nature.

Self-preservation is instinctive in man and animals. When seeing a known danger, the impulse is to avoid it. Some animals are provided with an armor of shell for their self protection; some take refuge in flight and some by their own strength make defense. Man, in addition to having the senses of sight and hearing, has a brain trained to recognize danger which when known is generally avoided.

By frequently placing ourselves in danger and escaping injury, our minds become calloused and dangerous practices continue until eventually some one gets caught. What we should do is to keep our minds active in the safety cause and thus avoid letting them get calloused by long years of indifference. *Accidents do not just happen, but are made,* or the condition is made that causes them, and we all therefore should see that these conditions do not exist. The safety movement is for this sole purpose. The greatest factor operating toward the prevention of accidents is not the prevention device but the prevention spirit.—*Ex.*

✽

Test Compensation to Posthumous Children.—Payment of compensation to almost one thousand orphans will rest upon the result of an action brought in Pennsylvania against one of the large insurance companies of the country.

The compensation board had decided that a child, born six days after its father's death, was entitled to compensation until she became sixteen years of age. The insurance company took exception to the finding and has taken the case to the courts, where it now rests.

✽

Employees Bonus at Saxon Company.—Each office employee who has been with the Saxon Motor Car Corporation for over ninety days has received a bonus of five per cent. of the

salary received during the year or for the term of employment if less than a year. Each factory employee shared on a like basis with those in the office department, except those who have been paid on piece-work basis and these have received a bonus of three per cent. These payments were made on September 1.

President Ford states, "This does not bind the company to a policy of bonuses each year. It is hoped that the payment of this bonus will encourage each employee to study his work to the end that each one may increase his efficiency." "While this first bonus is paid on flat percentage in the future a record of each individual employee will be taken into consideration. Punctuality, carefulness, obedience to all company rules and regulations, loyalty, willingness to coöperate with the desires of the management at all times will be taken into consideration in payment of any bonus that may be decided upon in the future."

✱

Ninety-Two Laws Passed to Aid Labor in One Year.—Ninety-two statutes beneficial to labor were made law by Congress and the various states according to a survey made public on September 4 by the American Association for Labor Legislation.

Most significant were the Federal statute prohibiting the shipment in interstate or foreign commerce of the products of child labor and the other providing a model scale of workmen's compensation for personal injuries among Federal employees, of which there are more than 480,000.

✱

Compensation Act a Success in Pennsylvania.—Announcement was made on September 11 that out of 50,000 cases in Pennsylvania involving workmen's compensation only eleven were taken to the courts for final settlement.

Forty-nine thousand of the cases were decided without recourse to other means than the mere conference between employer and employees. Less than 900 were settled by referee and 107 were adjusted by the Compensation Board.

✱

Tuberculosis in Trades.—A study has recently been completed by surgeons of the public health service of tuberculosis among the industrial workers in one of the large cities of the country. As a result of that study it is estimated that probably a percentage as high as 19.3 of tuberculosis is due to occupational hazards and to working conditions.

These hazards are not inherent in the occupation but are due to harmful influences which may be removed. The elements of poverty and poor housing conditions are factors intensifying this disease.

One hundred and fifty-four establishments and 19,932 employees were covered. Among the entire number 220 cases of tuberculosis were discovered.

The report recommends for relief the institution of state industrial insurance and the improving of housing conditions among employees.

✱

Model Houses for Workers.—The Westinghouse Electric & Manufacturing Co., will shortly begin the erection of hundreds of model houses for employees. These houses will be along lines laid down by some of the foremost experts on small homes in the country. They will be built under contracts calling for the erection of 100 houses and eventually there will be 600 in the group. It is expected that the plan will become a model for all industrial communities.

The houses will be of four, five or six rooms and will contain every modern convenience. All streets and avenues will be parked and shade trees will be planted. The general idea is to make the surroundings pleasant and the rentals such that it will be possible for any employee of the company to live in the colony.

✱

Spinners Adopt Eight Hour Day Resolution.—At the closing session of the three days' annual convention of the International Spinners' Union of America recently, at 724 Washington St., district reports showed improved conditions with wages advanced from 15 to 20 per cent. since the last convention.

Forty delegates, representing 20 districts, attended. Resolutions urging a general eight hour workday for women and children and favoring health insurance were adopted.

Personal Notes.

Dr. William Davis, for many years vital statistician of the Boston Health Department, has been appointed Chief of the Division of Vital Statistics of the United States Census Bureau.

*

Dr. L. D. Bristol, a graduate of Johns Hopkins, formerly on the faculties of Minnesota and Syracuse Universities, and for the past two years Professor of Bacteriology and Hygiene, and Director of the State Public Health Laboratories at the University of North Dakota, has accepted the newly created Boston Dispensary Fellowship in Public Health in the Department of Preventive Medicine at Harvard Medical School, Boston.

*

Mr. Barnett Cohen, of Savannah, Ga., has resigned his position as Assistant Bacteriologist in the Health Department of Savannah to accept a position as Research Assistant in the Department of Public Health, Yale University.

Dr. Herbert R. Brown, assistant director of the Massachusetts State Department of Health, has accepted the position of pathologist to the Rochester Homeopathic Hospital, Rochester, N. Y.

*

The following persons have been elected to membership in the American Public Health Association:

Albert Yates, M. D., South Main St., Washington, Mich., Physician, Surgeon.

Leon Gilbert Woodford, M. D., Everett, Wash., City Health Officer.

L. L. McDougal, B. S., M. D., Booneville, Miss., Physician.

Wm. Muhlberg, M. D., Cincinnati, Ohio, Life Insurance Co.

I. A. Abt, M. D., Chicago, Ill., Physician.

Wm. Scheppegrell, M. D., New Orleans, La., Physician.

Harry B. Sears, M. D., Beaver Dam, Wis., General Practice.

Robert W. Love, Moorefield, W. Va., Health Officer.

Chester T. Butterfield, U. S. P. H. Service, Cincinnati, Ohio, Bacteriologist.

Harold H. Mitchell, State Board of Health, Indianapolis, Ind.

Benzion Liber, B. A., B. S., M. D., New York City, Physician.

Arthur W. Hedrich, Boston, Mass., Chemist.

Lawrence Stevens, M. D., Bridger, Mont.

Howard A. Streeter, M. D., Marblehead, Mass., Chairman Board of Health.

John R. Baylis, Jackson, Miss., Manager Jackson Water Works.

Charles F. Lynch, M. D., Lansing, Mich., Health Officer.

Paul H. Duff, S. B., Charlestown, Mass., Student at Harvard Medical School.

Wade Wright, M. D., Boston, Mass., Head of Industrial Clinic, Massachusetts General Hospital.

John J. Griffin, M.D., Sault Ste. Marie, Mich., Health Officer.

Robert G. Patterson, Ph. D., Columbus, Ohio, Assistant Professor Ohio State University.

Aaron P. Pratt, C. P. H., York Village, Me., Health Officer.

Charles A. Gardner, M. D., Columbus, Mont., Physician and Surgeon.

Margaret A. Rogers, R. N., Detroit, Mich.

Current Public Health Literature.

AMERICAN.

American City, New York.

XV. September.

A New Census Report of Municipal Statistics.
The Water Supply of Portland, Maine. J. W. Graham.
Housing in Massachusetts Towns. Gabriel Farrell.

American Journal of Diseases of Children, Chicago.

XII. September.

Scarlet Fever, Morbidity and Mortality. Based on Several Million Cases. H. H. Donnally.
Types of Pneumococcus Found in the Pneumonias of Infants and Young Children. Martha Wollstein and A. W. Benson.
The Epidemiology of Pertussis. Introductory. Paul Luttinger.
Observations on the Intradermal and Repeated Intradermal Injection of Diphtheria Toxin with Reference to the Schick Test. D. M. Cowie.
An Anaphylactic Skin Reaction to Diphtheria Bacilli. J. A. Kolmer.

American Journal of Nursing, Baltimore, Md.

XVI. September.

In Preparation for the New York State Examination. Jane E. Hitchcock.
Acute Poliomyelitis. Emma Moynihan.
A Sanitary Contrivance. Peter F. Quinn.

Some Suggestions for School Nursing in a Small Town. Amy F. Lowe.
Diseases of the Nose. C. R. C. Borden.

Boston Medical and Surgical Journal.

CLXXV. September 21.

The Rat and Infantile Paralysis. A Theory. Mark W. Richardson.
Some Medical Aspects of the Workmen's Compensation Act. Francis D. Donoghue.
The Major Divisions of Mental Hygiene: Public, Social, Individual. E. E. Southard.
What Recent Investigations Have Shown to be the Relation between Mental Defect and Crime. A. W. Stearns.
Idiosyncrasy of Cow's Milk: Its Relation to Anaphylaxis. T. B. Talbot.

Engineering News, New York.

74. September 2.

Double Tank Proposed for Residential Sewage Plants. W. S. Coulter.

September 9.

Local Water Tested by Laboratory on Wheels. J. H. O'Neill.
Special Devices Installed to Improve Operation of New Mechanical Filters. E. E. Harper.
Ideal Organization for Water Works Described.

September 23.

Water Works Practice Discussed at New England Association Convention at Portland, Maine, September 13, 14, and 15.

Journal of the American Medical Association, Chicago.

LXVII. September 16.

The Prevalence of Chronic Mouth Infections and their Management. F. B. Moorehead.
The Principles Involved in Local Infection as Related to Systemic Disease. Frank Billings.
Dental Infections and Systemic Disease. E. E. Irons.
Direct and Indirect Hay Fever. W. Scheppegrell.
The Interest of the Community in Cancer. Louis I. Dublin.
Comparttive Results in Antirabic Treatment with the Pasteur Method and with Desiccated Virus. D. L. Harris.
Colonic Infections: Some Rarely Observed Unclassified Types. J. M. Lynch and W. L. McFarland.

Medical Times, New York.

XLIV. September.

Should Terminal Infection be Abolished. R. H. Creel, L. R. Williams, H. W. Hill, C. S. Caverly, J. D. Robertson, J. S. Neff.
The Vagaries of Boards of Health. R. W. Wilcox.
The Detection and Control of Typhoid Carriers of Disease. F. M. Meader.
The Menace of the Biting Stable Fly. J. W. Redway.
Food and Feeding in Infancy. J. Epstein.

New York Medical Journal.

CIV. September 2.

The Preëxisting Condition of the Injured. (To be concluded.) G. R. Doré.
The Resuscitation of Persons Apparently Drowned. J. O. Carrington.
Effective Sewage Disposal. Editorial.

September 9.

Tuberculosis in Relation to Feeble-mindedness. Peter H. Bryce.
Dysentery in Serbia. J. Rudis-Jicinsky.
A Test for Syphilis. G. B. Ubel.
Drug Addiction. E. W. Marlan.
The Relation of Diet to Diseases of the Skin. Albert Strickler.

September 23.

Occupational Specialisation in the Defective. H. M. Friedman.
The Problem of Adolescence in Relation to Social Hygiene. H. W. Wright.

Safety Engineering, New York.

XXXII. September.

Fire Hazards of Ammunition Manufacture. W. B. Milne.
Central Safety Stations in Coal Mines. H. M. Wilson.
The Real Meaning of "Safety First." John Annal.
The Power to Order Structural Changes in New York Factory Buildings.
The Statistician or Rate-Maker. A. C. Hendrick.
Safety Work in Gas and Electrical Industries.

Southern Medical Journal, Birmingham.

IX. September.

Operation of Vital Statistics Law in Arkansas. C. W. Garrison.
Registration of Births and Deaths in Dallas, Texas. E. B. Summers.
Vital Statistics Vitalized. W. L. Helzer.
The Need of Uniform Health Regulations in Southern States. D. W. Jones.
Symposium on Vital Statistics. Discussion.

United States Public Health Reports, Washington.

XXXI. September 1.

Poliomyelitis. Its Interstate and Intrastate Control.
Anopheles Infectivity Experiments. M. Bruin Mitzmain.

September 8.

Poliomyelitis.

September 15.

The Sewage Pollution of Streams. W. H. Frost.

BRITISH.

Journal of State Medicine, London.

XXIV. September.

The Disposal of Human Excretor in the Tropics. Angus MacDonald.
How to Save the Teeth of Children. J. H. Gibbs.

Medical Officer, London.

XVI. July 29.

The Statistical Evidence of Cancer Increase. F. L. Hoffman.

August 5.

The Treatment of Syphilis by Salvarsan, Galyl, and Kharsavan. C. S. Thomson.

August 12.

War and Lunacy.
Adenoids and Physical Defects in Children. H. R. Burpett.

August 19.

Children's Care Work in London.
The Causation of Dental Decay.

September 2.

Housing and Town-Planning, 1915–1916.
Bacteriology and Present Status of Specific Treatment of Pneumonia. Rufus Cole.

September 9.

The Public Health Service as a Career. John Robertson.
Degrees and Diplomas in Public Health.

Public Health, London.

XXIX. September.

Hygiene and Public Health: Some Needs of Post-Graduate Teaching and Training. H. R. Kenwood.
The School Medical Officer and the Tuberculosis Officer. Frank C. Shrubsall.
Acute Epidemic Cerebro-Spinal Meningitis. C. S. Thomson.
Meat Inspection. William J. Howarth.